INTERNATIONAL SYSTEMS BUILDING ROUND TABLE CONFERENCE

BOSTON ARCHITECTURAL CENTER 1971

COVER

Professor Yoshoshika Utida, who described the Japanese Pilot House Program at the ISBRT Conference, sent a post card of thanks from San Francisco on his way back to Japan from a trip he and several other Japanese made to investigate our Operation Breakthrough experience. The post card was entitled "Double Exposure". Whether or not it was Professor Utida's intent, I saw in the subject of the painting a subtle reference to the present state of the building industry and to the reason for our Conference: Instead of seeing what is really happening, people are still focusing on established, traditional concepts from the past.

"Double Exposure", a painting by Homer Ansley. "A panoramic view of San Francisco's principal tourist attractions." The painting is part of the collection of the Vesuvio Cafe, well known Bohemian bar on Columbus Avenue in San Francisco's colorful North Beach quarter.

We wish to thank the Smith Novelty Company, Inc. of San Francisco, owner of the Copyright of "Double Exposure", for permitting us to reproduce the painting on our cover.

D. Wilson

INTERNATIONAL SYSTEMS BUILDING ROUND TABLE CONFERENCE

SYNOPSIS AND PROCEEDINGS

OF THE FIRST

INTERNATIONAL SYSTEMS BUILDING

ROUND TABLE CONFERENCE

NOVEMBER 17 - 19, 1971

BOSTON ARCHITECTURAL CENTER

SYNOPSIS by Sanford R. Greenfield

PROCEEDINGS edited by Duncan Wilson
and John Cummings

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ISBRT CONFERENCE DETAILED PROGRAM — LOCATION

WEDNESDAY 17 NOVEMBER 1971

REGISTRATION	BAC
WELCOME USA: Professor A.G.H. Dietz INTRODUCTION Canada: C.H. Davidson	Cascieri Hall
EUROPEAN KEYNOTE ADDRESS UK: G. Lawrence "Systems Building in Europe: The Process- Not the Product"	Cascieri Hall
AMERICAN KEYNOTE ADDRESS USA: B. Kelly "Systems Building in the United States: What If Systems Building Works?"	Cascieri Hall
LUNCHEON SPEAKER France: G. Blachere "The Technico-Economic State of Building in Europe"	Sheraton Boston Hotel
RECONSIDERATIONS OF ACCEPTED THEORIES Italy: C. Testa "Operational Approaches to Systems Building" Canada: R. Robbie "Building Standards for Systems Building"	Cascieri Hall
CASE HISTORIES: HOUSING Italy: R. Meregaglia "The Balency System" USA: D. Crane "The Operation Breakthrough Experience" Holland: J. van Ettinger, Jr. "Problems & Methods of Low Cost Housing" USA: N. Mitchell "Implementation of a Building System"	Cascieri Hall
COCKTAIL PARTY	BAC

THURSDAY 18 NOVEMBER 1971 LOCATION

CASE HISTORIES: EDUCATION — Cascieri Hall

UK: (panel) "The CLASP Experience"
J. Black, P. de Brant, S. Meyrick, H. Morris
USA: (panel) "The Surge Building/Stony Brook Campus Experience"
F. Matzke, P.J. Meathe, R. Ruckterstuhl

CASE HISTORIES: HEALTH CARE — Cascieri Hall

UK: (panel) "Health Systems Building"
R.H. Goodman, E.M. Hoskins, P. Ward
USA: C. Arnold "A Summary Description of the Veterans Administration Systems Project"
USA: S. Clibbon "Innovation in the Design of Health Care Facilities: Some Influences of Systems Building"

BOX LUNCHEON — BAC

THREE CONCURRENT PANEL DISCUSSIONS

GROUP 1 - HOUSING PANEL — Third Floor Studio

Moderator: USA: J. deMonchaux
Panelists: Italy: R. Meregaglia; Holland: J. van Ettinger, Jr.; France: G. Blachere; Canada: C.H. Davidson; UK: J. Garnham Wright, G. Lawrence; USA: D. Crane, N. Mitchell, P. Wilson.

GROUP 2 - EDUCATION PANEL — Cascieri Hall

Moderator: USA: J. Eberhard

Panelists: UK: J. Black, P. de Brant, S. Meyrick, H. Morris; Italy: C. Testa; USA: R. Jacques, R.C. Kantz, T. Lee, P.J. Meathe, R. Ruckterstuhl, F. Matzke

GROUP 3 - HEALTH CARE PANEL — Third Floor Lecture Room

Moderator: UK: G. Best

Panelists: UK: R.H. Goodman, E.M. Hoskins, P. Ward; USA: C. Arnold, S. Clibbon, J. Falick, R. Zambrano

SPECIAL EVENING PRESENTATIONS — Cascieri Hall

Introduction: BAC: S.R. Greenfield

Peru: E. Paredes "Solving the Housing Problems of the Poor in Lima"

Japan: Y. Utida "Pilot House: The Operation Breakthrough of Japan"

FRIDAY 19 NOVEMBER 1971 LOCATION

ROLES OF THE PARTICIPANTS IN THE SYSTEMS BUILDING PROCESSES

INTRODUCTION — Cascieri Hall
USA: M. Brill "New Processes for Making Us Smarter about Building"

NINE CONCURRENT SEMINARS — BAC

1. "Emergence of New Roles and New Players in Systems Building"
   USA: J. Eberhard, J. Falick

2. "Evaluation of Processes and Products in Systems Building"
   France: G. Blachere; UK: G. Best; USA: R. Ruckterstuhl

3. "Behavioral Considerations in Systems Building"
   UK: P. Ward; USA: S. Clibbon, D. Crane

4. "User Needs Considered in Development of Performance Specifications"
   UK: S. Meyrick; USA: R.C. Kantz, T. Lee, F. Matzke

5. "Research: Where Is It Needed? How Much of the Right Kind Is Being Done? Who Is Doing It?"
   Holland: J. van Ettinger, Jr.; UK: H. Morris; USA: M. Brill

6. "Development of Design-Aid Tools for Systems Building"
   UK: E.M. Hoskins; USA: N. Mitchell, J.C. White

7. "How Political and Economic Systems Tend to Favor Different Approaches to Building"
   UK: R.H. Goodman, G. Lawrence; Italy: C. Testa; USA: L. Charkoudian

8. "Codes, Legislation and Legal Aspects of Systems Building"
   UK: J. Garnham Wright; USA: P. Wilson

9. "Does a Universal, Multi-Purpose Building System Make Sense?"
   Canada: C.H. Davidson; Italy: R. Meregaglia; UK: P. de Brant; USA: C. Arnold, J. de Monchaux

BOX LUNCHEON — BAC

ENCAPSULATIONS OF THE NINE SEMINARS — Cascieri Hall
One reporter from each of the Seminars

REACTIONS FROM A EUROPEAN — Cascieri Hall
UK: H. Morris

THE SUMMING UP — Cascieri Hall
USA: J. Eberhard

PART ONE: SYNOPSIS

SYNOPSIS

The first Boston Architectural Center International Conference was held on November 17, 1971 on SYSTEMS BUILDING. The idea for the conference developed from a series of round table discussions on the subject chaired by Ken Wilson and with the help of a group of energetic young men working in Boston: Roger Cassin, Charles Chaloff, Robert Chase, John Cummings, Robert DeVore, John Ellis, W. Easley Hamner, Michael Jolliffe, Richard Krauss, Nicholas Kuhn and Edward Tsoi. Both the Center and the Committee are indebted to the experience, advice and wisdom of Al Dietz, Professor of Building Engineering, Department of Architecture, Massachusetts Institute of Technology, Cambridge, Massachusetts, who provided continuing counseling before and during the planning states of the conference. A special vote of thanks goes to Colin Davidson for his participation in pre-conference meetings and for the difficult task of moderating three days of discussion.

Over 200 people attended the conference from 30 different states and provinces. Thirty-six speakers made presentations representing eight different countries, including the United States and Canada.

The Boston Architectural Center's goals have always included continuing education for practitioners, by offering separate courses, conferences, and a forum for continuing dialogue on various issues. The international systems building round table conference was a success, we believe, because it fulfilled some of these objectives.

The following is an attempt to summarize as objectively as possible the more detailed conference proceeding transcripts which follow in Part II of this publication. I approached this task with some trepidation in as much as summarizing inevitably means editing, and in turn, selecting based on one's personal priorities. Inevitably it means making value judgments in regard to major portions of the contents of the proceedings.

In as much as all the presentations are recorded verbatim and in full in Part II I am secure in the belief that I will be ultimately forgiven for any unsound, frivolous and hasty decisions.

Colin Davidson's introduction establishes the goals for the conference--an international exchange of experience. He believes it is characteristic of the building industry that we don't know each other or what everyone else is doing.

". . . . a building system is a method which generates a glossy brochure. . . ."

He intentionally polarizes the European and American experiences in building as follows: Europeans have emphasized hardware, and only incidentally discovered software problems; North Americans are overly concerned with software and only incidentally emphasize hardware.

Burnham Kelly provides the general introduction and history of system building in the United States. Systems building is more than a nuts and bolts problem. It is part of the larger system of developing communities in which we live.

Kelly traces the special contextual characteristics of building in the U.S. Land is not a priceless heritage but a speculative commodity. The real estate tax is the main resource of local government and has a speculative base. Real estate is a private function allowing for private opportunity. The public function is to guarantee against loss of security. In the U.S. we rely upon "consumerism" to keep the economy moving rather than looking at the problem of housing in a broader way. Historically the government has aided industry, the almost single exception to that rule being housing.

Kelly briefly reviews the history of industrialization in this country, including Bemis, Burchard, Fuller, Atterbury and Neff, Lock, Ingersoll, Fisher, G.E., Gunnison, Levitt and the mobile home industry; he reviews even the non-systems approaches of the Wyatt Program and Lustron Corporation, and concludes with the present day management by government--Operation Breakthrough and Title VII. He is critical of the incompleteness of the current building concept. It should be designed for maintenance and easy replacement of parts.

He returns time and again to his original thesis: The need for community, i.e. relating elderly to schools, schools to family health, good services and shopping. Resources should be allocated to the development of land on the outskirts of our urban areas and at the same time he raises some interesting questions regarding those areas. Can the U.S. government establish effective community building standards? If it does, can it afford to build to those standards? Can government continue to forfeit large developmental decisions to private enterprises?

Michael Brill, in a brilliant and delightful manner, argues that to create quality in the built environment, we are less concerned with the specific production and more critically concerned with the process of conveying the product to the consumer.

There are five critical issues: 1) performance of the total system; 2) identification of the problem; 3) cultural predispositions; 4) performance orientation and accountability to the consumer; and 5) feedback process. He uses the analysis of the total system of a federal office building as part of a federal information processing system which includes, in addition to building, people, facilities, policies, energy, etc. When looked at from the total system viewpoint, the cost of the building is only two percent.

One of Brill's many innovative ideas is a career entitled Environmental Diagnostician--someone who asks probing questions about basic functional needs, rather than the standard type of architect who offers quick and singular solutions without alternatives. He also sees the industry and its relationship to the profession with a fresh eye, which makes the commonplace appear as a strange phenomenon. (See his humorous dissertation on the cultural disposition of private property.) Housing is not well understood because we traditionally view it as a product, not a process, and it is the process which has to be basically altered to find solutions by infusing the system with new knowledge and insights.

Roderick G. Robie, in one of the most important presentations of the conference, predicts: 1) building standards and codes will have an international political impact of major importance; 2) building standards and codes will be used to manipulate national cultural aspirations and objectives by controlling the flow of building products; and 3) systems will force a control mechanism over national building industries and become a political tool for international political and economic objectives. Robie takes a global, interculturally potent view of the impact of systems building. He points out that the industry exerts great leverage and patronage on local government levels, but little influence at the federal or national level, despite its dollar volume.

With the passing of military warfare as a tool for international politics, international building symbolic of a nation's power, skill, and prestige might very well become the prime outlay for large scale spending.

With the growth of building as an economic war industry, human and cultural purposes could be lost. For that reason, cultural impact is an important consideration when framing building standards and codes.

With the passing of military conflict as a means of resolving international differences, rapid changes in life styles will occur.

In Fulleresque fashion the reduction of military spending will result in a "traumatic growth in consumer product production" impacting on international travel and communication and resulting in a universal world culture.

Astute countries will prevent the importation of wholly premanufactured housing which imports foreign cultural values without first passing it through a user-approval process. If we insert potent cultural clauses in building standards and codes, we will insure that an international public shall inherit its environmental birthright.

The first requirement in establishing building standards and codes is vastly increased user research. In addition, professional certification should include an examination in social and user aspects of building. In sum, Robie believes that regulating building is the most effective protection of our Spaceship Earth against pollution.

Neal Mitchell explains his particular system of building which utilizes a bolted-together flexible frame and panel system. The flexibility extends to columns and beams, and mechanical systems which allow for interchangeability. The system achieves the capability to change over time as user needs change, e.g. family growth.

He makes an eloquent plea for designer sensitivity to the life styles of the poor; new approaches to planning and financing; and achieving ease of maintenance and replacement of parts in housing. He ridicules government bureaucracy, conservatism, and vested political interests, which affect not only design, but the lives of the inhabitants of the buildings as well.

David Crane talks about Operation Breakthrough as his organization has experienced it at Jersey City where they are prototype site planners for the government, providing 490 dwelling units on 6.35 acres of land 20 minutes from Lower Manhattan. Their objectives are to accomodate three different system producers, a maximum variety of dwelling units for families with a social and economic balance of residents, and to demonstrate that design and innovation in site technology can make an important contribution to the humanization of large scale repetitive housing. They proposed a radical mixed land use concept, mixing space use within structures, in handling the parked cars, in the utilization of energy, waste disposal, etc.

In an honest self-evaluation, Crane states that the failures were not due to a single primary culprit such as HUD, or to Systems producers, or even to the architect; rather it was the whole team which failed to demonstrate that families can live together in high density. However, they managed to hold to the objective of providing community facilities and providing a feasible land development. The major failure has been the infeasibility of the building system.

"They have not provided the means for an architecturally superior environment of mixed use buildings, large at-grade family units, 100 percent structured parking, and maximum open space."

Phase III will be different in that they will have an opportunity to fit the system to a set of objectives which have been previously determined.

SURGE is explained by Frank Matzke of the State University Construction Fund. It concentrates on the Stoney Brook campus experience in Long Island. This presentation emphasizes systems management, sophisticated techniques in cost control, an intimate knowledge of the building process, utilization of critical path techniques, and maintenance of construction options.

State University Construction Fund is a public benefit corporation, established by an act of the New York State Legislature in 1962 for the management, design and construction of all state university facilities in New York. Design and construction is financed by a bond/issue, amortized by tuition. Increasing inflation made it necessary and desirable to design fast construction methods. Their technique, known as fast tracking, leads to the reduction of total project time by overlapping the states of design and construction, rather than the traditional inear sequential process in which approvals are required at the end of each phase and prior to the beginning of the next phase. In order to implement the fast track technique, you need a good design/build team and you must know what you want before you start.

Bob Ruckterstuhl defines SURGE as:

"a highly flexible facility designed to meet a great variety of disciplines on a short term basis."

At Stoney Brook they found it desirable to disregard the traditional user program and adopt a generalized program which anticipates the needs for a second, third and even fourth user. Phil Meathe of Smith, Hinchman and Grylls, in undertaking a large part of the dollar volume and building volume, agreed to design and construct six buildings in eight months and eleven days and, in two and one-half more months, complete an additional five buildings. They met all of their schedules and estimated that they achieved a 78 percent savings in time over conventional methods.

Sheila Clibbon's thesis is that while there is a need and desire for quantified analytic information, the amount of data is so great that even with computers, it could not be handled in a meaningful way. The problem is to determine what kinds of information to provide. We need to design other systems components which fit a specific category of architecture. They are:

Type I: "Architecture of Revealment," where interior and exterior coincide (Louis Kahn and/or the New Brutalists).

Type II: "Architecture of Concealment" of which there are three subdivisions:

a. Dead spaces: the kinds of buildings in which there is no relationship between interior and exterior and in which interior decoration is a major design tool;

b. Access panel architecture: here she uses the example of a five-foot suspended ceiling;

c. Crawl-space architecture which allows for some kind of less-than-human interstitial mechanical plumbing space.

Type III: "Architecture of Complement," which she describes as designing and constructing associated spaces with primary spaces.

Sheila concludes,

"there are three static systems of like spaces, and a group of dynamic systems for movement of people, animals, commodities, substances, power and information," which are called Patient Fostering Spaces, Consolidated Clinical Techniques Spaces, and Industrial Techniques Spaces.

Chris Arnold reported on a case study of the VA hospitals and development of a building system program. The problems facing the VA are classic: 1) escalating construction and operating costs; 2) rapid obsolescence; and 3) dissatisfaction with building performance. The subsystems selected for study were structures, ceilings, partitions, heating and cooling, plumbing, and electrical distribution.

The other subsystems, such as exterior walls, communications, and materials handling were outside their scope. Their major determinants in dealing with the VA included national applicability and existing codes and regulations. Their approach was to develop "systems and integration" which eventually became "coordination." Originally they also preconceived a "kit of parts" which could be incorporated in a conventional set of contract documents. Among other preconceptions that they eventually abandoned, was that of performance specifications.

They produced a set of planning devices called space modules which consisted of eleven one-storey high rectangular volumes from 3,300 to 10,500 sq. ft. Each module was then tested to determine its best function (!) Eventually the development of standardized service modules and in-space modules became the primary planning device. This prototype design was a working hypothesis or model, which could serve as a conceptual framework for a rationalized design and construction process.

John Eberhard reviews the composition of the participants of the conference, the activities and events of the program, the content of three days of presentations and workshops in apple-pie order. He leaves us with several questions to ponder: Can we expect the professional to develop new codes of ethics for social responsibilities, while he still lacks the knowledge and skills which would assure his clients of his expertise? How do we bring about a change in society and in our collective aspirations when, on the one hand we have an expanding concept of freedom, and on the other hand an erosion of authority and tradition of basic value judgments? Finally, John believes that the conference brought us to the point in which general ideas were so well discussed that we are now aware of the lack of specific standards and hard knowledge.

For Carlo Testa industrialization is:

"a process which by means of technological developments, organizational concepts, methods and capital investment, tends to increase productivity and to upgrade performance."

Our failure is that we have accentuated productivity and neglected performance. He outlines four forms of industrialization: 1) prefabrication; 2) modular building systems; 3) rationalized buildings; and 4) intensive site production. He also details thirteen activities related to the process of building: research, development, land acquisition and improvement, building design, promotion, marketing, bureaucratic services, financing, production organizing, production, assembly organizing, assembly, and after-sale service.

He sees two basic organizational structures: Vertical, in which complete service from land development to after-sale maintenance is provided; and the second, Horizontal, in which the design and development of systems or components is provided but in which production and assembly is outside the control of the organization. The advantage of the Vertical organization is that it has complete control of its production and of its operation. However, a drawback is that it requires an enormous initial capital investment and has no flexibility once it begins to produce. The Horizontal organization on the other hand requires low initial capital investment and is much easier to start up. It also contains almost maximum flexibility. However, it lacks control over its production and depends upon more than one manufacturer. However, both forms of organization are incomplete because they don't fit the definition of industrialized building. Here the organization must not be a passive one, but an active one, i.e. one that goes out aggressively and sells its product. Neither of these organizations control its own market, which must be done through land acquisition and/or financing. Control of the market is essential to industrialization.

Gerard Blachere believes industrialization is more than technology; there are different kinds of industrialization and their operation depends upon their special characteristics, including the plethora of different code requirements. With the introduction of the Common Market in Europe, a single international code is necessary. He recommends that it be a performance code.

In studying the process, it is important not to forget the innovation of hardware. The most serious barrier to innovation is the cost barrier, i.e. the difficulties in developing new changes which will meet competitive market economics.

Blachere dispels some myths: 1) that industrialization cannot occur in an established material such as wood or concrete, but must be a new material of the science fiction genre; 2) that industrialization can only occur in factories, not on-site; and 3) that industrialization can only occur by using three-dimensional modules. The above myths are invalid. There is only one overriding constraint and that is cost.

The presentation suggests several forms of governmental aid for building: 1) aid to encourage a particular type of technology; 2) aid through the use of a fixed contract price with a single producer; 3) subsidization by matching the size of a market with an appropriate technology for a given producer; and 4) dealing with a single contractor based on a program, not a finished design, utilizing genuinely new technology.

In sum: 1) there is no hope for methodologies, which are non-competitive, to produce low cost construction; 2) the most effective technology is measured by that which requires the least amount of financial aid; and 3) it is necessary to minimize code requirements and share information on new developments.

J. H. Garnham Wright did not make a formal presentation, but submitted a paper of excellent quality in which he traces the history of building control through codes and regulation in the United Kingdom starting with:

1. The specific requirements concerned with structure, public health and safety.

2. Functional requirements (inadequate because the law did not spell out in detail what was suitable). Also, he points out that a regulation ". . . couched as a functional requirement cannot be relaxed or modified to keep abreast of change."

3. Performance standard--a form of control designed to give freedom to the designer in times of changing technology. There is a need for the development of user standards and consumer sponsored research. The future will change because in the new industrial society the market is no longer effective and is replaced by planning.

Consequently, the performance standards of old, even with consumer-sponsored research, need modification. One of the most important problems is the need to change legislative technique, several difficulties of which are:

1. The administrative problems: the technical problems of research, i.e. the need for research on user and physical requirements and the lack of funding.

2. Design methodology.

3. Consumer facilities for testing including the development of academic theories for assessing the performance of buildings.

In his sketch of the future we also catch a glimpse of Mr. Wright's wit:

"Ultimately, buildings as a whole will be given certified performance grades. . . . The law will state no more than the performance grade required: the design process, using certified and tested products will be computer aided, and the production and checking controlled simultaneously by computers. Enforcement Officers will certify computer check-outs on Wednesdays, and carry out the occasional random test on a build-product as a change from the long weekends in between."

In brief what Mr. Wright is saying is that building control techniques must adapt to change within the context of changing social and technological developments and that control will be measured by performance criteria; that performance criteria will be based upon knowledge gained from research and the organization of professional and technical skill. Even legal or design objectives will be identified in terms of performance, including their evaluation and relative priority.

Standards must be established that relate to feasible levels of achievement. Finally, all building control must be appropriately adapted to a contemporary modern industrial society. For a plan of action he proposes a reclassification of subjects, change in specificity augmenting research, evaluation, and implementation by performance criteria. Enforcement would be reorganized, testing procedures instituted and a revised language to coincide with the language of management.

Wright presents an erudite survey of the past, present and future of the problem of creating rational and workable rules and regulations for the control of building and of our environment. No summary can do it justice.

Stanley Meyrick, Hugh Morris, Joseph Black and Peter deBrant made a team presentation of the CLASP experience. CLASP = Consortium of Local Authorities Special Program. It started originally with seven members and has now grown to 20 plus 23 associate members. By pooling their needs, they created a demand large enough to generate building economies. They also pooled their professional resources. They began in 1957 with a $2.5 million budget and fourteen projects. Today CLASP has 200 projects and a $60 million investment.

There has been success in systems application to school building but not to housing. This may be due to the development of new and innovative educational ideas, which find a parallel flexibility in building systems.

Hugh Morris believes that part of CLASP's success is that it is a consortia of Users of buildings--not manufacturers, contractors, designers, etc. It consists of socially-oriented groups whose interest is in what their buildings do for the occupants. Aesthetics are a secondary matter. The role of the architect in the project is important because he provides a continuity of program development utilizing technically-flexible and evolving solutions, seeking feedback from his own work over a period of time.

Joseph Black represented the client part of the CLASP team presentation. In frank fashion he discusses the pros and cons (really!) of the CLASP application at the University of Bath.

Peter deBrant believes that the systems approach must be user oriented. A systems building in the wrong hands would lead to standard package solutions, unsympathetic to local conditions and insensitive to user needs. The role of the architect fulfills this responsibility in the total process. His major task has been to develop CLASP into a heavy system for educational buildings and universities--the so-called CLASP/Joint Development Project.

Howard Goodman described the planning and construction processes within the British National Health Service, and the concept of systems building as developed in the Department of Health and Social Security. Percy Ward then discussed three data bases as they relate to the Harness Program of hospital building: the manufacturers, the activity, and the production documentation data bases.

Finally Ed Hoskins described a computer system currently under development, including a computer-aided planning and design system, as well as a production documentation system. The HAP process (Hospital Assembly Program) addresses itself to creating development control plans for Harness hospitals. The SHEP process (Simulated Hospital Evaluation Program) process makes a comparative analysis of alternative hospital plans. The presentation is one of the most technical in the entire series.

George Lawrence reviews a number of contemporary examples of system building in Europe:

1. The Wimpey Method. The method produces high, medium and low rise buildings. In 1968 it provided 10 percent of housing in the United Kingdom by utilizing a continuous process of integrating design and production and including extensive research and development.

2. Heavy Concrete Panel Systems. Bison in Glasgow, Balency, Thamesmead, Tracoba, Wates, Skarne, Siporex. All are design/build services. These systems are competitive in the field of high rise, high density housing but not competitive with one or two storey houses of traditional construction.

3. School Building Consortia: CLASP and SCOLA. CLASP is a client (owner) organization fully cognizant of user needs, which designs components and arranges contacts for construction. It operates in Britain, France, West Germany and Italy.

4. Department of the Environment has a program for state buildings which is writing performance specifications for building components (i.e. doors, frames, fittings, partitions, windows, etc.) and taking bids for large quantities to be used over a period of time.

In addition, the Department of the Environment program will embark on a dimensional coordination study, which will have profound effects in eventually encouraging a more universal open building system.

Riccardo Meregaglia provides us with a building system theory based on personal experience involving two major variables: 1) the cost of labor based on supply, and 2) demand based on low income. He traces building solutions through five time periods beginning with traditional construction in the first time period, to pre-fabs in the second, systems in the third and fourth, and, finally, industrialization in the fifth.

Jan van Ettinger, Jr. provides us with a statistical review of the increase of housing productivity of labor in his native country of Holland. The increase in the cost of building in three years has been three times as great as the increase in the cost of living for a similar period. Rising costs of housing production are of concern because the building industry is in competition for consumer expenditures with television, cars, refrigerators, etc.

His presentation identifies three topic areas: 1) reaching optimum quality; 2) increasing productivity; and 3) working at low cost. He defines Rationalization as improvement of the use of tools and equipment, and Standards as a means of providing continuity in the building process. His definition of teamwork is not five architects working together, but the client, planner, architect, contractor, specialist and user working together during preparation and execution of a project.

Van Ettinger believes that our decision (values/priorities?) determine our resources. For that reason we need to develop an optimum process of decision-making based on testing of models, and research prior to full-scale mass production and use. We must consider investing at least one percent of our total cost in research and development like other industries, not 0.1 or 0.2 percent.

The establishment of a national institute or center is essential to coordinate our badly fragmented building industry. His brief history of the Boucentrum and its growth as an institution which is private, non-profit and has no subsidies--which condues government contracted research and self-sustaining programs in consulting, training, exhibition, publication, is relevant to the Boston Architectural Center's long-range goals.

The evening presentations of Ernesto Paredes of Peru and Professor Utida of Japan make an interesting comparison in the remarkable contrast they represent in terms of national goals, degree of technological sophistication and industrialization.

Mr. Paredes provides us with a new perspective on systems building and relates directly to Roderick Robie's paper. Housing is more than shelter from physical and economic evils: it is a social system which creates change and resources for development. He divides housing into two subsystems: a) modern industrial housing by established institutions; and b) housing for the poor by the poor. His principal concern is to improve the latter. The need of housing for the poor is documented by figures which show the increasing urbanization of minimum income families in Lima. For the poor, housing can become a family investment and the protection against inflation in an unstable economy (not like the middle class of the U.S.). Some of the problems to be overcome are the utilization of managerial and organizational ability with a shortage of economic and technical capacity; the inability to acquire legal title to land; and to overcome overstimulating mass media (advertising) to possess material goods. Paredes discusses the "Community Action Program" of Peru, in which they are carrying out small scale experiments in social mobilization through organization, new financial structures, and new work opportunities, as well as innovative procedures in design, technical assistance, and construction--all for poor users. Paredes believes that the housing problem is the incapacity of the present systems to meet the needs of the poor. This can be accomplished by: 1) Changing attitudes as well as fixed standards to conform to the realistic capacity of the system to produce; 2) Maximizing resources such as materials, finance systems, labor, intensive construction, new systems for ownership, new systems for organization of work and distribution of income; 3) Stimulating social mobilization; 4) Technical assistance; and 5) Dynamic education--not limited to the classroom. An accompanying slide lecture illustrates some of the specific problems and proposals being experienced in Peru.

By contrast, Professor Utida presented Japan's Pilot House Study, which is extraordinarily comparable to the United States' Operation Breakthrough, with six main categories of building which he enumerates in detail in Part II.

In reading the transcripts of the Three Panels, it appeared that the substances did not meet the standards achieved by the individual presentations. There was little information transfer--at least by way of the printed word. On the Education Panel, Meyerich reminds us that SURGE permitted a loose fit design that allowed for the accomodation of rapidly-changing educational needs; and Kantz pointed out from his experience that for a forty-year period, higher education spent twice as much on alterations as on original construction.

The Health Care Panel spent most of its time in informal dialogue concerned with interstitial space: flexibility vs. cost vs. other methods such as suspended ceilings, disposable buildings, etc. Of the three panels, the Housing Panel was the most articulate and profitable. The workshop provided a wide range of discussions including architectural roles, roles of the producer--traditional builder as well as multi-industries producer such as GM, ALCAN, Westinghouse, etc. The workshop observed that to develop a standardized process that will produce diversity and multi-models is difficult, because the standard product is essential for significant cost reduction.

The problem of varying housing for rich and for poor was discussed, comparing the basic space needs of both income types. Some believe the need for space is identical, but the need for finish quality varies. The panel makes the subtle distinction between the "cost" of housing (for the producer) and the "price" of housing (to the consumer) and all that it entails in terms of financing, subsidies, taxes, etc.

Unfortunately, there are incomplete records of discussion of the nine seminars. All that has been transcribed is the summary of the nine reports. From their brief conclusions it would appear that the seminars generated excellent dialogue. We can hope at best that communication between participants is achieved and that a broader understanding of the issues resulted. The summaries contained herein are excellent and it does not make any sense to summarize the summaries. At best I can recommend them to the reader. Nevertheless, there were a few high points worth noting: the one on new roles and new players, for example. Emerging roles are due to some new pressures: 1) threat to architects who lack traditional work in the present economic decline; 2) threat of turn-key or package builders; 3) multi-facility clients like UCD or the State University of New York Construction Fund; 4) increasing government control and entry into the building process; and 5) the needs to define the problem.

There are at least two items worth quoting from Jim Falick's report:

"In the future will the controls for architecture and building be with the private architectural engineering firms or will it be with those aides who are with the government, or will it be some super vertically integrated company that might be called Ford-Boeing-Austin in the future?"

and,

"The question came up at the first session as to whether or not the architect really was the man who was best motivated and trained, et cetera, to be in control of the environment or whether he was just looking for a job."

Of the new emerging roles he defines: 1) the linkage role between traditional and new modes; 2) management roles; 3) architectural firms that become an aggregate market; 4) client user community role; 5) multi-disciplinary roles other than above; and 6) the government player.

Neal Mitchell's report includes what appears to be a politicized statement as follows:

"In order to meet the overall needs and demands of the country, we will have to improve both the rate at which building is built and the quality with which it is built. This will require an expanded research effort to improve the process and to develop a rational means by which these buildings can be designed, financed, constructed, managed, and operated, and that in order to effectively deal with this, these national needs and demands, we feel that the government must structure regional research and dissemination facilities that can gather available information and resources which can be tapped by various building industry interests and which also demands feedback for publications of all results to stimulate additional and continued involvement."

And, finally, Hugh Morris has provided the ultimate summation by quoting an unquotable quote,

". . . we have reached complete unanimosity."

Sanford R. Greenfield
Boston 1972

PART TWO: PROCEEDINGS

WELCOME

ALBERT G. H. DIETZ

U.S.A.

I have the pleasant and presumably non-controversial task of saying, "Welcome, glad you are here, and hope you have a good time." I really ought to stop right now, because anything else I say might be controversial.

One of the principal reasons for establishing this conference was the rather rapid development of this area that we call "Systems Building", or sometimes "Building Systems". Some people think that these terms mean industrialized building and others say it should be the industrialization of building. Many other phrases and words are used to describe this amorphous thing that is happening in the building field.

As a matter of fact, I invite you to consider that when we use the terms "building systems" or "systems building" and so forth, we really haven't defined whether the word "building" or the word "system" is a verb or an adjective or a noun. Depending on the order you put them in and what interpretation you put on these words, you can come up with almost anything.

Perhaps this conference might come up with a definition.

It is a favorite topic of conversation, of course, wherever architects, builders, or engineers get together, to wrangle about systems building, and, of course, the students are the ones who really go to town on this topic.

In this conference we will be talking both hardware and software. I am quite sure both of these topics will come up, and we hope they will. We also hope that there will be considerable differences of opinion as to what they are.

Because of this situation of rapid development of something which is hard to define, we have invited, in the terminology of the old-time Hollywood press agents, a galaxy of stars from abroad and from this country, people who are acknowledged "experts" and at least active in this field.

We hope, therefore, that we will have a conference which will be equally active and fruitful. We think it will. We want a good, free discussion.

Before I close I should like, however, to salute the committee and the Boston Architectural Center for making this space available and giving its full support, as well as to the National Science Foundation whose financial support, in part at least, made this whole thing possible.

The members of the committee are Roger Cassin, Charles Chaloff, Robert Chase, John Cummings, Robert DeVore, John Ellis, Easley Hamner, Thomas Holzbog, Michael Jolliffe, Richard Kraus, Nicholas Kuhn, Edward Tsoi and the chairman of the group who has put in a tremendous amount of effort; it says Duncan Wilson here, actually everybody calls him Ken.

I would like now to introduce Colin Davidson. Colin has had wide experience in this field; trained as an architect, took his Master's Degree in Architecture at M.I.T., went back to England where he has been very active, developed his own system-- perhaps he is a good man to define what we mean by systems, as a matter of fact.

He is now back in North America where he has been commuting for the last couple of years between St. Louis and Montreal; at Washington University and the University of Montreal where he has been very active in this area. He has introduced the rather select, I think, but highly competent publication, "Industrialization Forum", which he continues to head.

One reason, additional reason, we selected Colin to act as moderator, however, is that we think he is going to have the ability to get this audience off its hands and get you to participate fully and freely and perhaps acrimoniously in the proceedings. Colin?

INTRODUCTION

COLIN H. DAVIDSON
CANADA

This is the beginning and end of formalities, because we want to get down to three days of hard work.

We are going to hear a lot of things that we approve of, a lot of things we don't approve of, a lot of things we wish we could understand, but don't, and so on. The only way to arrive at these things that we are wishing for and maybe not getting is precisely to approach the whole conference on a "no holds barred" basis.

So, the name of the game is no formalities. Say what you think, ask the questions that you feel have to be asked; don't spare the speakers and they won't spare you.

I don't intend to make a speech at this time, but simply to raise three sets of points.

Firstly, to discuss very briefly the good old triad of goals, objectives, and methods in the context of this conference.

Secondly, for the sake of argument, and I mean literally that, I shall give some definitions; and thirdly, also for the sake of argument, I shall make two wild generalizations about Europe and North America for reasons that I shall explain when I get to them.

On the question of goals of this conference, I suggest that our goals are an international exchange of experiences. I stress the word experiences because it has specific meaning; through an international exchange of experiences we should enable our building activities to become more systematic. I was going to say more like a system, but I think it is wise to keep to this non-jargon word of more systematic.

The objectives of the conference which concern you and me here, is that if our building activities are to become more systematic, we should learn from other people's experiences what our position in the building industry is. We all think we know what we are doing, we all think we know who we are, but one of the characteristics of the building industry, I suggest, is that we don't know who the other people in the industry are, we don't really know what they are doing and we certainly don't know what they think about us.

Therefore, the objectives of this conference are to situate ourselves in the building industry through hearing about other people's experiences.

I shall be defining the word system in a minute or two and this definition will include the word relationship. I'm suggesting that the objectives of our conference are for each of us to identify our relationships with other people in the building industry, the relationships between what we do and what they do, and between how we do it and how they do it.

We must aim at getting direct exchanges between us whenever possible. We will be listening to the speakers, we will be trying to understand what they are actually saying, we will be trying to imagine what it is that they have actually done; but we have two other questions we should be asking. When they say something, what do they actually mean? When they did something, why did they do it? If what he meant is not clear from what somebody says, we must ask him; if it is not clear when he says what he did and why he did it, we must ask him. If anybody starts to make outlandish and general claims in the name of humanity, society, or one of these other "in" things nowadays, like, for example, "I know how to solve the building industry's problems" or "I know what the industrialization of building is", then this person should get what he deserves. I leave it up to you to think that up. (Laughter).

Incidentally, without having looked at the list of registrants, I believe that the vast majority of the audience are architects and the next largest number are engineers. It may be chastening to remind ourselves of two definitions of architects and engineers, both for reference to ourselves and for reference to the speakers. Neal Hutcheon, who is director of the National Research Council of Canada, Divison of Building Research, who is about as cynical as directors of research stations can get at their best, has said the trouble with architects is that they do not know the meaning of the word truth. Somebody else, whose name I won't mention, has also tried to define engineers, and said the trouble with engineers, of course, is that they know everything about everything and nothing else. (Laughter).

So this, I think, shows the kind of bridges that we have got to cross between each other, between the speakers and the audience, and between what is actually happening in the building industry and all of us safely enclosed in this room.

Now, in a conference in a field of science, a field of science that is well served by selective dissemination of information, abstracting services and things of that sort, one can be reasonably sure that some of the information being exchanged has already found itself into the SDI or abstracting services. Even so, in these other fields of science, people come to conferences because they are the best way of actually exchanging information.

In the building industry which has no effective SDI systems and has very few abstracting services, it is even more important that we should regard this conference as a prime and unique occasion for actually exchanging information. For this to take place during the next three days I suggest that we should abide by three rules, three rules of the game.

Firstly, I suggest that there should be no applause at the end of any of the "speeches". If it were in an academic situation, the only time that the students applaud their professor is if he slips on a banana skin (laughter), and if it is a friend of yours, the only time you applaud him is if he has downed more beers in half a minute than anybody else. (Laughter).

Since this is neither of these two situations, I think applause is formally out. So, after the statements that the various people will be making, we will go straight on and without a break, please, into discussions and arguments about their statements. If en route the person made such really extraordinary remarks that you just, you know, are waiting to get your hands on him, then the best thing to do is simply to butt in. Whether he will like you for that or not is his problem, not mine. (Laughter).

When time runs out we will be quite pitiless about the speakers who run over. It is not my fault if the program only allows 15 minutes for a life's experience or 20 minutes for some two or three people's life's experience. This is the way the program was set up and we must abide by those rules.

And the third rule concerns the summing-up. John Eberhard is listed to sum up this conference on Friday. Don't count on his summing up. I imagine that Eberhard has probably already written his speech of summing up. (Laughter). I imagine he thought about it a year ago. (Laughter). The best way you can get information out of this conference is to sum up for yourselves as you go along. So the ball is fairly and squarely in all our courts to do the summing up for ourselves.

Now, I said that I was going to give some definitions and I'll stand by that. I give these definitions for one reason and one reason only, and this is that in a group such as ours there is bound to be divergence as to the meaning of terms.

In proposing definitions I would ask subsequent speakers to either agree with them or state that they disagree with them for certain reasons. Now, I am not implying that my definitions, which indeed are not mine, are better than anybody else's definitions, but they will give us a basis for starting to agree on terms and then deciding why we think the terms need to be modified.

I was looking at the title of the conference in order to arrive at what terms should be defined. Looking backwards, the first words to

define were "round table". Now, I haven't seen any round tables in the building, so I don't know whether we have to bother to define it. I think that when the sponsors of this conference put the words "round table" into the title, they set a very difficult challenge for us to actually perform on the basis of a true round table-- exchanging the truth in our search for the Holy Grail.

Now, the second set of words are "systems building", without the apostrophe.

In arriving at a definition of systems building, I would back up to the word "system", and I give you here the definition given by Arthur D. Hall in his fundamental book, "Methodology of Systems Engineering" published by Van Nostrand: "System: a set of objects with relationships between them and between their attributes". The most important word in my opinion is the word "relationship": relationships between objects; relationships between attributes; relationships between people; relationships between what the people do. I referred to this earlier on in talking about ourselves, identifying our positions in the building industry. This is precisely what I was alluding to.

"Building (so the Oxford Dictionary tells us, is): constructing, by putting parts or materials rightly together..."-- incidentally a verb, denoting an action.

So then, system, if we accept that it is a set of objects with relationships, leads us on, of course, to a number of other words, hybrids that combine systems with something. Systems building we can obtain from the two earlier definitions. Systems approach is one of the buzz words particularly on this continent at the moment; the systems approach to problem solving being one use, and the systems approach to building being another use of the term. In each case the operative word is system.

I should also mention a further combination of the word system; namely, building system in England and systems building its American counterpart. I use here a definition of John Weston, formerly of the Building Research Station: "A building system is a method of building which generates a glossy brochure." (Laughter).

This definition was initially aimed maliciously at the producers of large concrete panels and small steel sections. But it actually would be more honest if we were really to throw this definition maliciously at all of us, because while we recognize without blushing that the proprietary systems are exploiting the glossy soft sell for a number of years, we have also to recognize that the publicly sponsored approaches to building have also been having a glossy soft sell for a number of years-- I'm thinking about CLASP in the UK and SCSD in the USA, about which we hear almost too much. If I raise this point here, it is precisely because this is the unique opportunity to find out what really went on behind the scense. If somebody tells you that such-and-such a thing happened and it all went very well, it is high time to jump up and say, "Yes, but...," because you are getting the glossy soft sell once again.

Now, a word which is not in the title of the conference is "prefabrication", and the reason presumably that it is not in the title of the conference is that I imagine there is an immorality board in the Commonwealth of Massachusetts, and if the word "prefabrication" had been printed and sent across the State boundaries, it would presumably have been breaking some kind of Federal Communications law. (Laughter).

So, prefabrication is the word that we don't use much nowadays. It simply tells us where things happen.

The key word in the title is "industrialization"-- this is really what it's all about. In order to put up a definition of industrialization, I conducted a lengthy bibliographic search and found what I consider to be possibly one of the best definitions. It is borrowed from a little publication of the Royal Institute of British Architects entitled "Industrialization and the Architect", dated 1965. The definition reads as follows: "The organization of building industrially, applying the best methods and techniques to the integrated processes of demand and design, manufacture and construction."

One other word that I wanted to define because it is bound to come up at this conference many hundreds of times is, of course, performance. It will be used as the performance concept, performance design, performance specification, performance description, and so on. I suggest that a definition to start with is that of James Wright, published in "Build International" about a year ago which is, "An organized procedure for stating desired attributes in order to fulfill requirements without regard to specific means." Note: requirements and not means.

The last point I want to raise is to throw out a dangerous generalization, again for the sake of argument, about the composition of the team of speakers here and about what has been happening in Europe as opposed to what has been happening on the North American continent.

I would state, at the risk of being proven wrong in the next few minutes, that the Europeans, if they are truthfully to tell us what has been going on, have to confess to having approached the industrialization of building from a preoccupation with hardware, and to have slipped unexpectedly into discovering that there are software problems that go with the hardware.

On the other hand, I would suggest that the North Americans, aware that the North American building industry is in such a highly fragmented state of affairs that it is almost impossible to do anything about it, have been spending some time talking about software, and occasionally, as if by mistake, some hardware actually happens.

Let us then assume we have a dichotomy of approaches; hardware emphasis from Europe, a software emphasis from the United States. If we can in fact fuse these two divergent approaches, then I for my part feel that we really will be in a position to progress towards industrialized, system building.

Now, it is very convenient to end this way because the first person to prove me wrong will, of course, be the European keynoter. I invite Mr. George Lawrence to take my place here. Mr. Lawrence?

SYSTEMS BUILDING IN EUROPE: THE PROCESS– NOT THE PRODUCT

GEORGE H. LAWRENCE
U.K.

The first reaction on receiving your invitation to give a "European keynote address" was to write round to a number of knowledgeable people in those European countries which are using systems to obtain some up-to-date statistical information to help assess the progress and development of system building in each country. At the date of preparing this paper, the replies had been neither sufficiently numerous, nor comprehensible to enable a comparative assessment to be made.

Trends in Europe

The United Nations annual bulletin of Housing and Building Statistics for Europe giving 1968 figures is available, but a glance at this brings home the fact that these enumerate the product whereas what we are concerned with here is the purpose. Accordingly I am proposing to deal with the subject using only such statistics as are required to illustrate particular points. Extracting the proportion of Industrialized Building for housing in Europe in 1968 one finds the following comparative figures:

Chart 1:	% I.B. All Dwellings	% I.B. Flats	% I.B. Houses
East Germany	-	93	-
Sweden	-	92	-
Norway	-	76	35
Czechoslovakia	-	70	54
Bulgaria	45	-	-
Netherlands	40	-	-
Turkey	40	-	-
Hungary	35	-	-
Italy	30	-	-
Yugoslavia	26	-	-
France	-	25	20
West Germany	6.3	-	-
United Kingdom	-	34	32

In Western Europe the general climate of opinion in the construction industries and associated professions is that there is a trend towards a policy of encouraging more open systems of building as opposed to closed systems whose technology, design disciplines and documentation procedures are aimed at satisfying a limited set of user requirements in the building conditions of a particular market. This trend however discounts the undoubted success of some closed systems in particular markets and ignores the relatively much slower growth of those conditions which would encourage the wide development of open systems, sub-systems and dimensionally coordinated components.

This is markedly in contrast with the progress of industrialized building systems in Eastern Europe over the past twenty years.

In the U.S.S.R. the process is undertaken by state agencies. A state planning agency produces type plans for housing. These are used by other agencies in the planning layout done locally. Contracting agencies are organized on a regional basis. This relatively simple organizational structure favors the development of very advanced technology.

The space standards however are low by Western standards and layouts tend to be stereotyped.

In all cases however one of the main factors in the encouragement of industrialized building methods has been the need to use scarce manpower in the most productive way at all stages in the process both before and during construction. So far as operatives are concerned there are the related factors of the decline in craftsmanship and the emergence of semi-skilled labour. Another factor is the clear advantage to all concerned of shorter building times. So far, lower costs, in spite of claims to this effect, have not normally been achieved. Lower costs are not a relevant point. They arise only when the authority setting the cost limit is different from the client body. When the same body makes decisions on cost and times, they can be made in light of all the circumstances.

Systematic Approaches to Building

If one consults the Concise Oxford Dictionary on the meaning of the word "process", one finds, "process, n. and v.t., Progress, course, esp. in process of construction etc. being constructed etc. in process of time. As time goes on; course of action proceeding, esp. method of operation in manufacture."

Confining our consideration for the moment to the process of design, manufacture, assembly and erection, and taking the definition "course of action", I would like to look at one or two approaches to systems building currently in use to see what are the strengths and weaknesses of each.

First the Wimpey method which at the peak of the housing drive in 1968 captured 10% of the U.K. public sector market-- 20,000 out of 200,000 houses. Many people might regard their product as traditional building, but their approach is very systematic.

Wimpey operates a continuous process of development with an integrated design and production staff of 700. They obtain weekly feedback from every construction site with computerized statistics on allocations of man/hours and the like, with a view to refinement of the product. Their research and development department is impressive. They are currently attempting to introduce plastic extruded cladding and wholly prefabricated interiors. The innovative techniques are introduced gradually in one or two regions until proved. The firm offers products in a wide range of high, medium and low rise houses.

My second example is the heavy, concrete panel systems of which there are many operating in Europe-- across national borders. The organizations concerned have committed substantial capital sums on the establishment of casting factories and training of operations. They have been competitive in the field of high rise dwellings and mixed-height, high density developments, but have seldom been able to compete with traditional methods in one and two storey cottages and terraces. (Figs. 1 and 2).

They have found it most profitable to offer a design/build service which enables them to relate internal house planning to the disciplines of the structural system. In Britain their factories have seldom done more than single-shift working and in some cases half their factory space has been taken up in casting special job components. This is a situation which we can examine later. (Figs. 3, 4, and 5).

My third example is that of the school building consortia, such as CLASP and SCOLA. The former is operating in Britain, France, West Germany and Italy. Here it is the client organization which in full knowledge of the scope of user requirements, designs the component parts of the building system, arranges annual contracts with suppliers to the extent of about 60-70% of the total cost and works with small local contractors for assembling and work on site. In an inflationary situation they have been more successful than many in holding costs steady. (Figs. 6, 7, 8, and 9).

My fourth example is the Department of the Environment method for crown buildings [state buildings] using the opportunity presented by the change to metric measure to introduce standards and dimensional coordination and working closely with the British Standards Institute. Currently, they are writing performance specifications for doors, frames and fittings, partitions and windows. They are inviting bids for quantities of work to be taken up over a period. At the same time Departments are producing governmental recommendations for dimensional coordination and performance standards and are undertaking studies on joints, tolerances, etc. (Fig. 10).

Time does not permit me to expand on the many small local systems, mainly lightweight systems involving timber engineering. These fulfill a need for housing both in France and in Britain.

Influences of Market Conditions

The nature of the product is in fact influenced by the market conditions in which it is produced. I think it would be time well spent if we were to examine the whole process of procurement of buildings, the agencies involved and their responsibilities starting from the basic essentials of land, money, time, materials and labour and ending with the built environment of a quality which is socially acceptable by the community who will live and work in it.

Responsibilities

Town planning ordinances and Building Regulation

Fig. 1 Flats. Building System: Bison Wall Frame. Greenock (Glasgow), Scotland.

Fig. 2 Flats. Building System: Tracoba. West Bromwich, England.

standards are the responsibility of central and local governments. The former do not affect system building more than other methods. In so far as residential density in concerned, high density schemes have favoured industrialized methods.

Chart 2: PROPORTION OF HOUSES TO FLATS IN EUROPEAN COUNTRIES 1968

Group 1: More houses than flats (to nearest 1%)

	% Houses *	% Flats**
Eire	82	18
United Kingdom	73	27
Netherlands	69	31
Yugoslavia	68	32
Norway	67	33
Belgium	61	39
Denmark	54	46

Group 2: More flats than houses

	% Houses*	% Flats**
West Germany	44	56
Bulgaria	45	55
Turkey	42	58
Greece	39	61
Austria	37	63
France	37	63
Finland	36	64
Sweden	29	71
Italy	27	73
Czechoslovakia	23	77
Switzerland	18	82
Spain	4	94
Hungary	1	99
East Germany	0	100

* Defined as one or two dwelling houses
** Defined as multi-dwelling houses

Source: U.N. Statistics

There is always a danger when regulations are made that people will find ways round them. The Five Storey Wimpey blocks is perhaps an unhappy example of such a case. Building regulations in England and Wales stated that in walk-up flats a person should not have to walk up more than three stories to the entrance door of a dwelling. By putting two maisonettes on top of a single storey flat, five storey blocks were possible. This model has been built in large numbers throughout Britain.

Building regulations originally drafted to safeguard public health and safety, unless they are so framed as to lay down the performance required rather than method of achieving it, may inhibit innovation both in materials and methods. In Great Britain there are now central regulations bypassing local bylaws which produced widely differing requirements between one area and another, and created an impossible situation for larger firms.

In social building programmes funded or subsidized from the public purse, the responsibility for framing minimum space standards and maximum costs again rests with central government. This sets the guide lines within which designers must work. In such programmes, the client is normally a public body, housing authority, education authority, hospital board, etc. In the United Kingdom in the 1950's and 1960's, the situation got out of balance in that local housing authorities which were small and unable to attract professional staff either in numbers or of the quality required were the clients for large housing schemes. Private architects with a few honourable exceptions, regrettably performed so badly particularly in controlling costs that this resulted in contractors offering a design and build service-- the Package Deal-- which tended to confuse responsibilities, particularly for environmental design. Nevertheless where firms were sponsoring systems it allowed all the designers to be in the right place as part of an integrated team with the production men-- that is, closed systems.

There are 1,633 housing authorities in Great Britain. The movement to group them into client consortia has not made any progress. In Britain one of the most difficult tasks has been to persuade client bodies to organize themselves into groups which can influence the market. CLASP in the School Building field is a notable exception to the rule: Here one authority with two problems-- a large school building programme, and sites subject to mineral subsidence-- devised a system; sought neighbors with similar problems; and developed from there. The programme now covers many building types, runs at 20 million pounds per year, and has a majority of non-subsidence sites.

Reform of local Government scheduled for 1973 may redress the balance but housing as a responsibility has been relegated to the lower tier authorities.

The balanced market situation of large, well-staffed clients giving sponsors of systems for house building a fair long-term expectation of a share of the market to enable them confidently to invest in factories and equipment and to train their labour force to work on a permanent rather than

a casual basis to produce and erect dwellings, has never been achieved in Britain during the housing drive of the 1960's. The result of this was to decrease the competitiveness of such systems.

At 6 A.M. on 16th May, 1968 an explosion occurred in a corner flat on the 18th floor of Ronan Point. It blew out the load-bearing flank wall and as a consequence the corner construction both above and below the construction collapsed. Fortunately casualties were few. (Fig. 11).

The incident set off a shock wave across the length and breadth of the country which has produced a widely held reaction against high rise dwellings and system building. The latter, combined with a cut back in house building through economic stringency, has resulted in housing authorities resorting to traditional building in preference to system building for the great majority of their schemes.

The National Building Agency

May I here mention some of the aims of the organization which I represent, The National Building Agency. We were set up in 1964 to give assistance to the building industry and its clients with a view to promoting increased efficiency and productivity and facilitating the introduction, adoption and use of improvement building methods. The objectives include assisting clients of the industry, both public and private, to pool their building requirements together and to collate them into phased programmes.

Appraisal of industrialized building systems is only one of our roles; a separate agrement board was established to deal with innovative materials.

We have undertaken studies of the whole process of building procurement from inception to completion, with a view to improving the process of building in modern methods. For example, metric shells are a rationalization of the dimensions of two storey houses and have been helpful both to housing authorities and to builders. (Fig. 12).

In Scotland, working with a consortium of authorities responsible for 65% of all public sector housing, we have developed a concept of plan rationalization which allows twelve plan diagrams to meet the main stream of user requirements for two storey buildings. (Figs. 13 and 14).

We have also with builders tried to match the product to requirements.

We have undertaken studies in communications between designer and builder; buildability programs; and management of sites.

Design and Costs

Perhaps the most difficult part of the procurement process is that which concerns money. This is usually identified as the tender [bidding] stage, that is, when a contractor having given a price in more or less detail for a product to meet requirements which have been described and speci-

Fig. 3 Thamesmead, England. View across Southmere.

Fig. 4 Thamesmead, England. Stage 1: Linear Block from south west (Harrow Manorway).

Fig. 5 Thamesmead, England. Stage 1: General view from NW of Linear Block.

fied in more or less detail, then enters into a building contract to carry out the work.

It has perhaps been the exception for the normal, traditional procedures to be used where the client authority with its own professional staff, designs the houses and invites system builders to tender. A variety of methods have been adopted whereby sketch designs have been produced by authorities' architects, working drawings have been produced by contractors, some competition on prices or rates has been introduced, a measure of negotiation has followed, and finally a contract has been arranged. A method which has been widely adopted has been the design and build contract in which an authority with a site to develop has permitted a building firm, for a price, to do all the work on the basis of a brief [program] from the client.

At the risk of oversimplification I would suggest some principles which should be followed to get best results. First, the question of environmental design. This I believe to be wholly a client responsibility. Within the stipulations of the town plan on land use and density, the authority's architect prepares his three-dimensional layout scheme covering family mix, disposition and height of blocks, roads, parking, open space, etc. If the intention is to use industrialized building, it is probably best to hand over the detailed design responsibility at this stage to the architects in the sponsor's organization with a clear brief on plan performance and a performance specification of standards required.

It is at this stage that some element of competitive tendering can be introduced and it is here that the situation so often becomes obscure. I believe it is necessary for the client to know what plans he wants and which sponsors can produce them and for there to be a measure of agreement on appearance required. In this situation a small number of sponsors can be selected to produce their own versions of the blocks together with a specification and tender price for dwellings and rates for foundations and external works. These can be compared by the client of price and quality, and a final decision can be made on the basis of the best technical product at the most competitive price.

It was Oscar Wilde who in his plan "Lady Windermere's Fan" put into the mouth of one of his characters the description of a cynic, as "a man who knows the price of everything and the value of nothing." It is value for money that is the point of paramount importance in procuring buildings.

In the U.K., we have as members of the design team, quantity surveyors, who, by the medium of a bill of quantities can from the architects' drawings give a schedule in precise detail of the labour, plant and materials involved, thus enabling contractors to price in competition on a fair basis. You will of course realize that this does not quite fit the systems situation where a client's architect's drawings may not reflect the disciplines and constraints of system building.

It is nonetheless possible, with the aid of these indispensible people to devise ways of working so that the brief is clear. The means of communication between designer and builder leave no one in doubt as to what is wanted and a fair assessment can be made of the products offered by sponsors.

One point which must never be forgotten is that from the builder's point of view a predictable, continuing prospect of similar work enables him to marshall his resources in such a way that he can work economically. In a competitive situation this is reflected in the price he gives to the client.

Fig. 6 Residential School Hostel at Oban, Scotland, in CLASP construction for Argyll Country Council.

Fig. 7 School Hostel in CLASP construction at Dingwall, Scotland, for Ross and Cromarty County Council.

The Trend and the Process

I said earlier in my talk that the trend is towards a policy of encouraging more open systems and I described the Department of the Environment method as an influence in the trend, particularly in its work on dimensional coordinates. My current thoughts on the situation lead me to believe that the universal system, with its sub-systems, assemblies and catalogue of components, is still a dream of the future. However the more they can be introduced into systems devised for particular market conditions, the more productive will the industry become in husbanding its resources.

VOICE: Mr. Lawrence, you said that investigation in open systems is encouraged. Would you please repeat what is meant by open systems? How do they encourage it and why don't they succeed?

MR. LAWRENCE: I don't think I quite said that. I said that everybody thought it would be a good idea to move towards an open system. That I think is an encouraging move.

Some of the difficulties of doing this have already been mentioned: I think an architect would like to be able to say of the open system, "I am a systems man and I have all the catalogs. I look up all the systems and all the bids and put them together." In this way he would have the benefit of being a systems man without having the constraints which systems are apt to impose. That is why I think that unless the designer, the architect, the engineer are all part of the organization that is producing the thing, the thing is unlikely to work.

But if you do have a well-laid-down accepted set of rules for working on dimensions, on tolerances, on performances of various components, then you are on the right track. That is what the Department of the Environment is doing in the U.K. I don't know the size of their annual market, but it must be many thousands of millions of pounds worth of building in a year. It is open, too, and what they are doing is bound to be influential on making these things available for other people to use.

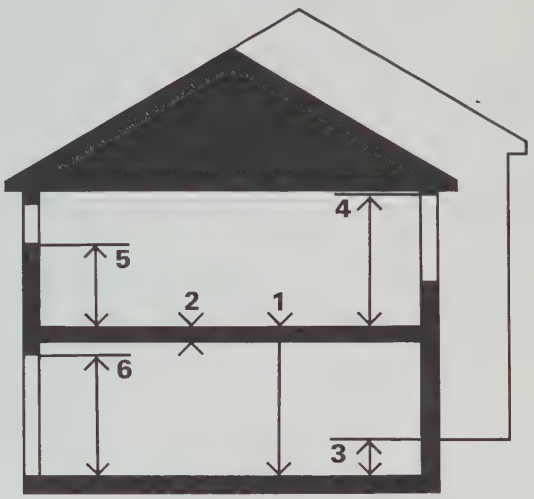
But as I have said all along, it is in fact the conditions of the market which influence the system, and so it may ease up a bit. Those under close control are likely to work best in the meantime.

Fig. 8 Secondary School Extension in CLASP construction for Selkirk County Council.

Fig. 9 Secondary School Extension in CLASP construction at Galashiels for Selkirk Country Council.

Fig. 10

Metric Housing
The Dimensional Framework



Recommendations — Section

Floor to Floor 2600 — 1
finished floor level to finished floor level

Floor Zone 200, 250 & 300 — 2
first preference 250. Zones include finishes

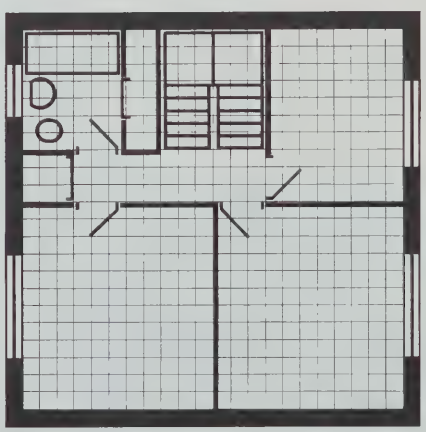
Change of Level 600 & 1300 — 3
within a dwelling or between dwellings

Window Head 2100 & 2300 — 4
first preference 2300

Window Cill 2100, 1800, 1400, 1000, 800, 600, 200 & 0 — 5

Door Head 2100 — 6

Recommendations — Plan



Planning Grid 300 x 300

Separating (party) Wall 200, 300 & 400
both faces on grid lines. 200 and 400 separating walls interrupt the grid.

External Wall 100, 200, 300 & 400
inside face on grid line

Loadbearing Partition 100, 200 & 300
100 one face on grid: 200 & 300 both faces on grid
200 load bearing partitions interrupt the grid.

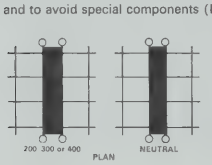
Non-Loadbearing Partition 50 & 100
one face on grid. For greater planning flexibility non-loadbearing partitions may have one face on 100 mm subdivision of the grid.

Column and Beam x 100
a line of columns and beams is treated as a partition. If it is 100 thick one face is on grid, if thicker, both faces are on grid. The cross sections are dimensioned in multiples of 100 mm.

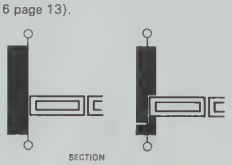
PROBABLE DIMENSIONS FOR METRIC COMPONENTS SUITABLE FOR HOUSING
Bath 1700 × 700, doorsets 800 & 900, kitchen fittings 600 depth × 100 length, sinks 600 × 1000 or 1200, straight flight stair opening 900 × 2700, dog leg 1800 × 2100.

Exceptions

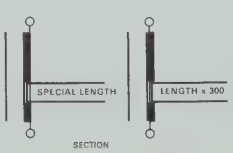
may be adopted to enable the designer to make the best use of standard components and to avoid special components (DB16 page 13).



Neutral zone
In certain cases where components of modular thickness (i.e. multiples of 100 mm) are not available the grid may be interrupted by a neutral wall zone related to the component thickness (DB16 page 21).



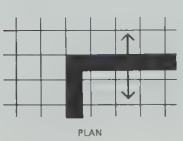
External wall on 100 mm subdivision of the grid
A non-loadbearing external wall may have its inside face on a 100 mm subdivision of the planning grid (instead of on the grid line) if, for example, it is supported on standard floor units which are multiples of 300 in width (DB16 page 8, 2d).



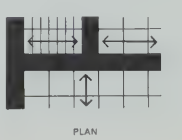
Finish outside the wall zone
The grid line may be on the structural face of the wall (instead of on the finished face) when standard components, such as floor units, must span between structural faces. (DB16 pages 13, 15, 16, 17 & 19.)

For flats only

200 partitions normally have both faces on grid lines and interrupt the grid, but in flats these exceptions should be adopted. (DB16 pages 22, 24 & 26.)



Non-loadbearing partitions
If a wall does not support the floor it should not interrupt the grid. (DB16 page 8, 2f)



Loadbearing partitions
may have faces on 100 mm subdivisions of the grid to relate the overall dimensions of different structural bays. (DB16 page 8, 2g)

NBA Design Aid 1 based on MHLG Design Bulletin 16. Metric Dimensional Framework.
The National Building Agency, NBA House, Arundel Street, London WC2.

Fig. 11 Close-up of damage to Ronan Point.

Does that answer your question or perhaps another question which you hadn't thought of asking?

VOICE: Yes. Thank you.

CHAIRMAN DAVIDSON: I would like to ask you, please-- Burnham Kelly made a plea for evaluation, and also referred to certain elitism that may be remotely possible in Europe. It seems to me that The Building Agency is evaluating and might be elite.

Could you tell us a bit more about your in-house experiences. Particularly, what influence do you think you have had on house building with systems in England?

MR. LAWRENCE: Well, first of all, can I say that the bulk of the good we did does not appear on the surface, in that when we were set up in 1964, we were incidentally told, "Hands off the high-rise systems"-- they knew all about those!

Therefore, we didn't spend a great deal of time on high rise systems. I'm not saying that had we had this as part of our terms of reference, we could have stopped something like Ronan Point from happening; although I would like to think that we could perhaps have been influential in avoiding that sort of circumstance.

When I say the bulk of the good we did doesn't appear on the surface, we stopped an awful lot of people who thought they had systems which they wanted to offer on the market from doing so; not by the process of the mother who turned to her daughter and said, "Go and find out what Little Tommy is doing and tell him to stop." It was by going in fact and speaking to Little Tommy himself, saying, "Do you think this is all right? Have you considered this? What sort of area are you going to work in? Have you studied the weather conditions; do you know what the exposure is; will this combat it?" And so on. And by a process of attrition we discouraged an awful lot of people from bringing systems onto the market which would have been a) unsuccessful in performance, and b) would have been disasterous, I think, from the point of view of profit-making for the firm concerned.

But that in fact is rather the negative side of the thing. We have worked with all the people who are trying to establish high standards of performance. I think all design is a matter of compromise and when I say high standards, I don't mean something which is going to cost twice as much and last twice as long; but a reasonable standard for what is a reasonable cost to pay for a particular article. We did in fact try to relate this to the economic situation of the country as a whole.

I was quite fascinated-- I was driving yesterday in a taxi through Manhattan and the taxi driver happened to turn on a small portable wireless that he had, just at the time when the commercials were on. A fellow was saying, "We have very good cars. You will be interested to know that 40% of the cars which were originally registered last year have been reregistered again and are still in use this year." [Laughter]. "We know that we are giving you a product made to last." [Laughter].

Well, I thought, well, there are slight differences perhaps between the economics of this country and the economics of ours. [Laughter]. My car is four years old and I recommend it is just about run in!

VOICE: In your experience, how did you evaluate projects that were built and what penalties were involved if they did not fulfill the specifications?

MR. LAWRENCE: When you say what penalty is involved, do you mean, how do you get at the chap who made the evaluation?

VOICE: Yes.

MR. LAWRENCE: Well, we have been running away from this one for as long as we can and as fast as we can, and so far with great success. [Laughter].

Because we come back to this business of closed systems. It is the chap who is responsible for putting the thing on to the ground, who signs a contract to do such and so for the client, who must undertake the campaign on how the thing works. The people who do the evaluation look at the product and discuss it with the man who made the product, what it is meant to do.

Testing is not done by our organization, but by others. Again it comes to the thing that falls down or leaks or whatever, which gets a great deal of publicity. The other 99 percent which works perfectly, nobody ever hears about.

Credits for figures 3, 4 and 5:
G.L.C. Photographic Unit.
Designed by the Greater London Council Department of Architecture and Civic Design.
Architect Sir Roger Walters, K.B.E., F.R.I.B.A., F.I. Struct. E., in succession to Sir Hubert Bennett, F.R.I.B.A., F.S.I.A.

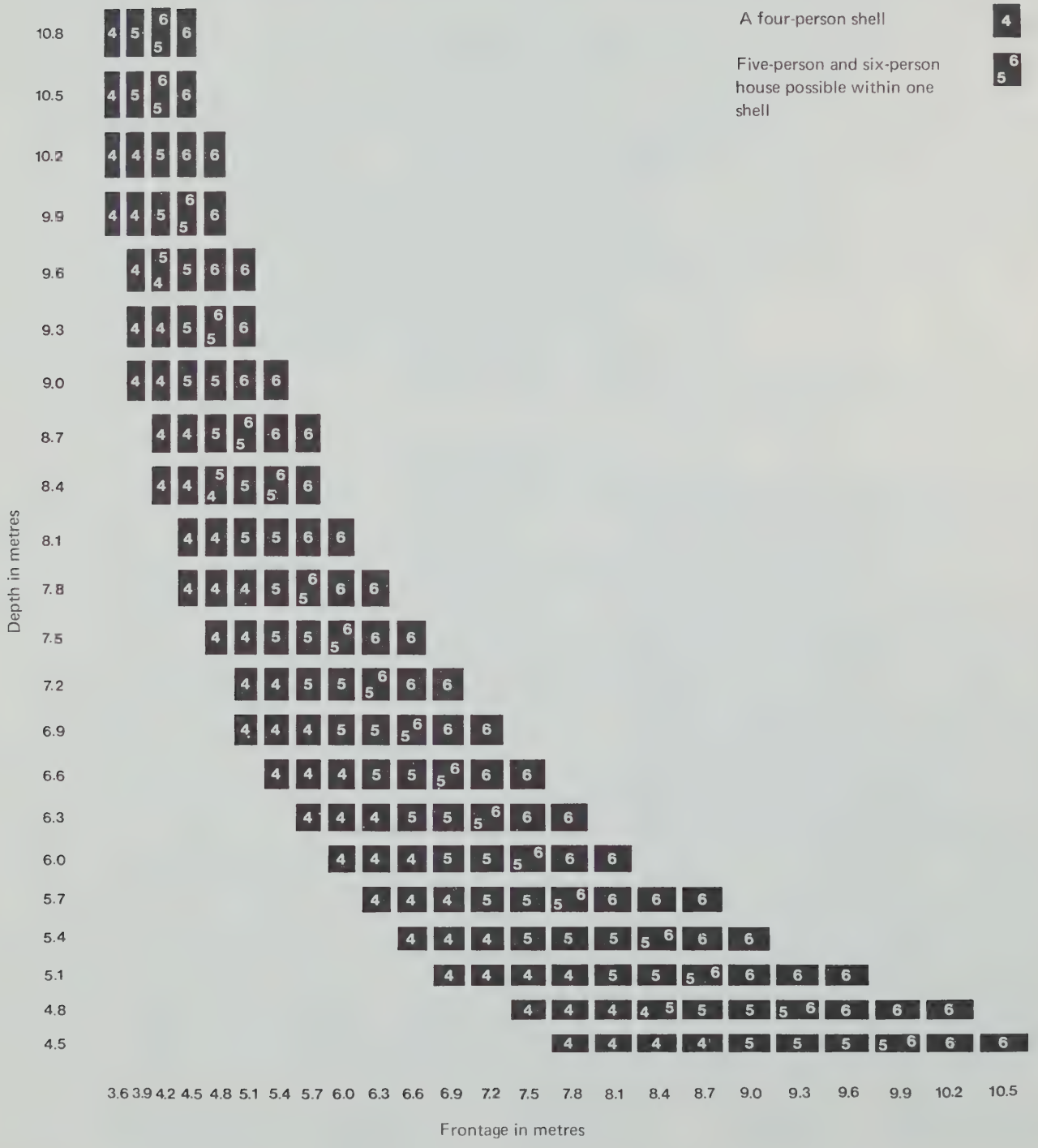
Fig. 12

The complete range of shells based on 300 mm increments of frontage and depth for four, five and six person centre-terrace two-storey houses

KEY:

A four-person shell

Five-person and six-person house possible within one shell



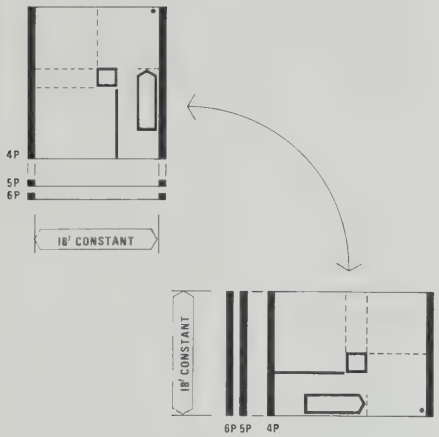


Fig. 13 Basic house design.

Fig. 14 Plans in series. Ground floor plans at left, second floor plans at right.

SYSTEMS BUILDING IN THE UNITED STATES: WHAT IF SYSTEMS BUILDING WORKS?

BURNHAM KELLY
U.S.A.

Those of you who know me know that I like to climb to the top of the ivory tower and look off into the distance and speculate, rather than to talk about details. I think that it is important for me to do this as a spokesman, shall we say, for the U.S., because most of us in the audience are familiar with what in systems terms is happening. However, sometimes we tend to forget what kind of a country we live in or what kind of problems we have to face.

My charge is to make a general introduction to the U.S. situation with respect to systems building. My aim is to take that charge literally and to raise problems at the very broadest level. Many of you may recall that twenty years ago in the Bemis Foundation we were earnestly trying to get the housing industry to understand the problems of industrial building-- that building was a system, in effect, and that the design of joints or the factory fabrication of panels were at best only parts. The true system spread far more broadly than this, involving problems much more complex than these technical problems.

Today I am in the unfortunate position of a man who sees his government beginning to adopt his views and now is wondering what will happen as a result. (Laughter).

For I am convinced that systems building, as currently pursued, is part of a still larger system by which living communities are developed and permanent additions are made to our urban structure. If systems people don't see this, then "successful" systems building could be a disaster. Some European experience illustrates the point.

As a background let's talk about the special characteristics of the United States as they relate to the problems of housing, land development, building in general, and so forth.

In the first place we are perhaps unique because from the very beginning we regarded land not as a priceless heritage but as a speculative commodity. We have had land rushes, land grants, homesteads, Westward ho! and boom-bust-boom; a man's home is his castle in the law but only because he wishes always to have the right to sell it to the highest bidder as fast as possible. For a few dollars, anything, anywhere, no matter how nobly it was built, no matter how well it serves its purpose will yield to a "higher use". By "higher use" the courts mean a larger profit. Yet houses and buildings are always in this country considered real estate in the long English tradition of that term, with the exception of mobile homes. Mobile homes are the only part of this industry that have made any substantial progress.

Secondly, the local real estate tax is the main resource on which the United States operates its local governments. The United States firmly believes that the local real estate tax should always have a speculative base since that will yield the highest return and pay for the most services.

Real estate enterprise in the United States has always been a private function. In any government at any period all of society comes down to a balance between security on the one hand, and opportunity on the other. You always must adjust what you are prepared to do in terms of security with what limitations you are thus placing on opportunity, or what you can achieve in opportunity that will increase security. It is always a balance.

In this country, opportunity regarding land has been firmly reserved for private enterprise. The problem of security has been firmly transferred to the public. So, public intervention has been allowed when we fear the spread of disease, when we fear the spread of the smell of slaughter houses; and the police power has moved in as the basis for most of our local controls and to regulate what we consider as important utilities. Until recently, even highways were always regarded merely as transportation services, somewhat analogous to sewage disposal systems, rather than what, of course, they are; namely, the very largest and most important aspect of the development of opportunity.

An exception to the United States view is the educational function. But I think a case can be made, looking at education over the years, that even there it has been until recently a service to teach people how to get back onto the farm and produce there, rather than to generate genuine opportunity.

I contrast with this most of the rest of industry. The government in the United States was always very free in spending money and giving legal power for mine owners, for railroad enterprisers, for shipbuilders, for aircraft industry producers, and more recently for the space program. There were regular tax credits, regular powers of eminent domain, all kinds of inducements which private industry was shocked to find after the Second World War and somewhat shocked still to find are not available in the housing area.

A third general point in the United States is our utter reliance on consumerism. We keep the economy moving by selling. If things slow down, we build more automobiles whether we want them or not. If the credit gets a little tough, we make it very clear that even the most conservative and respectable bank can charge 18% on any one of a number of cards to keep that credit flowing. We sell our houses by exterior "individuality" (and the quotes are intended), and interior gadgets. We sell our communities by providing lakes and golf courses and riding stables. In general we are operating by pushing at the top with consumerism rather than looking at any problem in a broad way.

Our entire so-called development control system of localized games aiming to preserve the noble qualities listed above. Let me repeat them: land is a speculative commodity; real estate development is a private function; and everything moves by consumerism.

I think nearly all have come to realize that zoning and subdivision control--and that was my field for a long time--are really methods, cosmetics, to preserve suburbia. We have now undertaken a series of studies, of which the American Law Institute study is but one, to put all the miscellaneous means of control of land and of land development into some larger framework, with a somewhat more noble purpose in back of it. They lean heavily on European models; but we haven't advanced very far yet.

When it comes to codes, I think we can all agree that the building code systems, even the most so-called performance-oriented systems and the national codes are essentially beautiful exercises in log rolling, manipulated by the largest fabricators and distributors of building materials. In the end we will get farther by not moving toward unifrom codes at all, but moving toward some sort of an evaluation system or procedure, with the code part of it kept as illustrations more than anything else.

The most effective control is, and always has been, money. In the field of building, money is a very important element. Capital requirements for buildings are extremely high, with a negative cash flow curve extending for many years, expecially for the infra-structure required for large developments. This is the control used mostly by the national government, partly because constitutional tests have told the national government to keep their hands out of local real estate control, but partly because that is the easiest way to operate anyway. The national government used this power originally as a counter-cyclic pump priming for the economy; later during the depression to insure the securities of the banks, to keep them solvent; and then to keep the mortgages of individuals solvent; and finally to finance development of suburbia through FHA and others with a few casual gestures toward public housing along the way. Until just the last two or three years, the national government never used its great powers to stimulate anything like an effective production system in building.

So, what has been the history of industrial systems in this country as a result of the factors that I have described? Mostly a sort of generalized stimulus to technical ingenuity in which the best examples are little noticed and the less sensibile examples are widely publicized. The old balloon frame, after all, was a pretty good limited system. It led to a whole new procedure for housing in wood. The steel frame led eventually to a whole revolution in urban construction.

There was for a long time and still continues a steady flow of joints, panels, and modular approaches. Most were already covered in the three volumes of Albert Farwell Bemis and John Burchard's book, "The Evolving House," which came out in 1936, and many published then were probably only being reinvented. There were some genuine revolutionaries--a generation ago--Fuller with his suspended house, his autonomous bathrooms and indeed his entire thinking; Atterbury and Neff with new approaches in concrete; Carl Koch's sectional and folding systems; and Ingersoll's utility cores. The ideas were all flowing around but no industrial system existed, no formal production procedure in which they could be seriously used.

Some other kinds of systems came out of this game, tied not so much to a single industry as to general industrial theory. Bemis for many years plugged the four-inch or ten-centimeter module, which our previous speaker has just noted as still being pushed. Fisher in the 1930's proposed a production procedure in which there would be no overall plant anywhere, simply a combination of shelter and service producers that would produce products designed for easy assembly assembled at any site. It was in the 1930's that Houses, Incorporated, got General Electric to go into an industrial cooperation which ended up with completely furnished full-scale houses being merchandised by Macy's. On the opening day the ribbon was cut by none other than Franklin Delano Roosevelt's mother.

So there were attempts. But what really began to make an impact were people like Gunnison and Levitt and the mobile home industry. They ceased to worry about substantial innovations and concentrated more on industrial management approaches having overall control and national distribution and keeping check on costs.

Well, since the Thirties, the government has moved more and more toward a concern for housing as such. It started in a mild way then, doing research in the Bureau of Standards and in the Forest Products Laboratory with plywood and plywood housing, mainly supporting the conventional approach of the FHA. The Wyatt Program, which many of you may remember at the end of the Second World War, encouraged the non-systems approach, and the best of the non-systems was RFC's famous Lustron Corporation, which produced a house each panel of which went through the manufacturing process without a single human hand laid on it, only to require an endless bridge of human hands to get it on special trailers and truck it out to the site and put it up. There was no truly industrial system to do it.

Recently, as a result of social pressures, minority pressurs, and urban-social pressures, a very strong concern for rational housing production was emerged on the part of the government, as reflected by industry. Industry looks for new outlets for its capacity; new areas for profit. It talks of space-age know-how, realizing the benefits of large scale operations, and increasing the speed of operations; also it hopes to realize the investment potentials of the resulting increments in land value.

A great deal of interest arose, therefore, in the European systems that have been developed by governments which had taken the management role that our government has consistently avoided. The design glamour that came out of Habitat and mobile home successes made our industrialists believe that at last we had a gimmick which would let us get into genuine industry production without going through the usual public resistances to forms different from those we have known in the past.

We have now reached the stage where the Department of Housing and Urban Development with its Breakthrough Program and its Title VII Program is trying specifically to encourage new producers and new developers. The government is exerting considerable pressure for code reform and for labor rationalization. In at least half of the states factory-housing laws are either passed or pending. Many states are adopting the model of the New York State Urban Development Corporation with its considerable power to override or at least to some degree neglect local rules, although very seldom is this actually done. We now have something like 70 different programs to assist developers in HUD; we have Fanny May and Ginny May and farm housing; and the administration has a specific interest in modular housing as a possible way of solving some of the problems of special shelter in outlying bases.

One should say that if it weren't for the recent downturn in the economy in the United States, the industrialization of building would be about to fly.

Now, I come to my main point: how complete are these systems that we are talking about? Most of them, even the broadest, end with a finished building, turn-key for the original user. How complete a system is that? The building continues to operate for years. It has to be maintained. It goes through depreciation cycles and some parts of it have to be replaced. If it were initially designed for that replacement, it would be a better system. Some of the developers insist they are concerned with this. By no means all, even of these few, have substantial prospects.

From an industrial technology point of view, some of the greatest values you can produce become possible if you assume that you are going to be in control through the subsequent life of that building. You will save money and increase service overall by putting in highly industrialized finishes or by designing your parts for appropriate replacement at the appropriate time in the building's life. Indeed, the broad, economic facts of life suggest that the whole field of housing should be regarded as a utility service, and that industry should think of itself as providing a service and getting in on production systems so that it can control the replacements and renewals over the years. The sooner we get rid of the notion that our systems are complete when we have assembled the building and sold the product, the better.

An even more important point is that systems typically don't extend beyond the structure itself, even if they do extend through the life of the structure.

What about the community of which any building is a part? This is clearly an essential aspect of any true system for the obvious reason, well underlined by research and by observation here and abroad, that a reasonably well-adjusted family in a reasonably well-functioning community will tend to perceive even a rather awful house as good, whereas a reasonably badly-adjusted family in a reasonably-badly functioning community will perceive even a very well designed house as terrible. Intuitively, we understand this simple fact.

Entirely aside from the high moral purpose of any academic, the high financial purpose of any large producer, and the high governmental purpose of any agency, we must be deeply concerned not only with the houses or the buildings that are produced by an industrialized system, but also with the communities that emerge as a result.

These communities require a whole range of services. The governments in Europe have a good deal to tell us about this. They have had to build houses in a hurry and in many cases they are having to go back and build the communities that make houses livable. In some cases they are having to suffer a good deal of local outrage because of the characteristics of the original community; and in some cases, it was a hopeless mistake.

The vast housing projects in Berlin that got such a black eye, did so because the subway extension that was planned, the regional shopping center that was planned, the extensions of the school systems that were planned; all of these things were not built, but still they went ahead with the houses.

We are told that in France some projects are considered to be more hotbeds of revolt than patterns of good living. There are in many of the other countries consistent efforts to go back over the ground now that the immediate crisis is over and try to provide some kind of a decent community for the people for whom they were originally giving shelter.

In London the metropolitan government has had a long experience. We have heard something about the way they have learned to base their operations not only on effective metropolitan planning and building, but on a government land policy and a government policy for the creation of decent communities.

Many industrial observers, when they come back from systems tours of Europe, take me into a corner and in a somewhat puzzled way say that what they liked the best was a project, say, in Denmark, where actually the system wasn't startling and the architecture, although nice, was modest; but the community really seemed to

work. Facilities for the elderly were associated in some way in the school system and the school system was associated in some way with the family health centers. Shops and services were good; everybody seemed to think it was great to live there.

I grant you Denmark is a small, homogeneous country where it is a lot easier to propose a pattern of life into which a system of buildings should fit. However, the lesson is there for us anyway. If you go to Eastern Europe, you find in country after country that the lesson has been learned in another sense. They are quite conscious of the importance of communities as opposed to mere housing, and their plans recognize this political fact. The relative focus on the community is intentional.

Now I come to my deductions. Clearly, the larger the scale, the greater the speed, and the larger the problem. In the United States we have a beautifully balkanized development control system and a beautifully balkanized housing production system. In their horrid way these two fit each other. But if we now really make some progress on the scale and speed and the production side, it is clear that we are in deep trouble on the control side: in the goal-setting, the policy setting areas. There is no time for traditional process of accretion.

Perhaps the worst situation is the one that gets the least attention of all. I speak of those large areas on the outskirts of our currently built-up cities and suburbs that are now either vacant or held in low-grade use or otherwise open for development. If we really are going to build all the urban America we say we are going to build, clearly most of it has to be in these areas. These areas are characterized by the fact that the men who now own them, the government in whose jurisdiction they are located, the builders who move in to develop them, and everyone else associated with the conversion to urban structure, are all going to disappear and be gone by the time people have moved in. They are also characterized by the fact that our great American practice of turning to the votes of the people--the democratic system--to find out what we should do is absolutely meaningless, since there are no people and no democratic system there to tell us.

We invest in our downtown urban problems and in our existing suburban problems probably something like 90 percent of our federal resources--money, energy, everything--and our foundation resources. Yet the area on the outskirts is the area where the biggest social improvement and biggest profit can be made. Nobody is doing very much about it. The only government in the United States system that I know that ever did anything forthrightly is Puerto Rico. A few years ago when the island was being inundated with buildings, the government in despair simply said, no more building until we set up some policies! They absolutely clamped down for something like nine months. Unfortunately, what they came up with is not what I think they should have come up with; that may be what will happen often. But at least they tried.

Part of the difficulty in the policy question is that people become deeply concerned with special aspects and they don't speak to each other. Government administrators tend to want results and efficiency for housing as though it were a separate function from community. For years researchers have been trying to show in health and mental health terms some direct relationship between what you build on the ground and what happens to the people. They have not gotten very far but are still working hard on it. The old familiar standards called "Planning the Neighborhood" are now pretty much discredited; but the efforts continue. Other experts feel that if only there are created effective social organizations, the rest will all fall into place.

There is some truth in all these views, but little broad policy benefit results from everyone moving off in different directions. At the present time the only operational government policy on the provision of community facilities seems to be that of setting up checks and balances and providing laundry lists of important considerations that new town developers must check off, although the government is so thoroughly committed to having new developments move ahead, that they try hard not to notice awkward deficiencies.

Now, from my already somewhat lofty ivory tower position, let me raise some even loftier problems. First, I have been arguing that we should have some kind of a policy for assuring effective communities. Clearly I am implying, am I not, that the government can set effective standards. Is this really possible? Can the United States, under the political pressures that our national government typically experiences, set effective standards? Or will it inevitably simply push up standards to the tune of the loudest and most powerful complainants?

The State of California builders as one man said they did not want the HUD guidelines for Title VII ever to be published and distributed because they were terrified lest these become incorporated in a whole series of local codes. They felt the guidelines were very noble aspirations, but that was all they should be.

A second question is this: can the United States afford the United States' standard of living? If we are serious about building high-standard com communities and building them for the whole range of our population, can we afford what we are talking about?

Probably some group is going to have to get into the business of reducing standards and reducing them intelligently in the right places. How, under the United States democratic system, does any government agency ever to that?

The third question: can the government continue to leave the large locational and basic structural urban development decisions to private entrepreneurial operations? At this point I think too much public power and resource is built into our housing programs, and especially into our new communities and large development programs, to let the choice of site and overall structure be that of the private entrepreneur. A change in attitude has occurred since the early days of the urban renewal program. The first urban redevelopment laws set out to encourage any insurance company, in return for limited profit, to come in and use the power of eminent domain and dominate the location and design decisions. After a while the public said, wait a minute, we had better make these basic, because so much of our public resources are involved.

I think we are well into the time now when we had better say, wait a minute, if we are going to encourage the rapid building of communities, we should lay out at least the basic policies and the essential grid with which developments will take place. We are not going to let them simply happen because somebody can buy 20,000 acres of land where a golf course and marina can be developed and lots of profitable middle-class housing sold.

The urban structure of the future takes its basic form from highway location, primary utility lines, and the location of industry--not from zoning and subdivision control and local master planning. What is best for Boise-Cascade is not necessarily best for California, even though Boise-Cascade is a reputable company and doesn't wish to do a shoddy job.

In the fourth place, we have the moral and political question of the use of general public funds for limited groups in the population. To what degree are we prepared to encourage developments that are too rich for the average family, and to omit the problems of the lowest income groups and particularly the minority groups? We have before us the sharp contrast between many new towns in Southern California and the proposed new town of South City. I don't see that the government is doing anything more than politically adjusting itself to both kinds of requests. It hasn't really made a policy plan.

Now, a last broad question: can a government plan effectively anyway? It may be assumed, in what I have been saying, that at the federal level and at the state level, by some means not entirely clear at the moment, one can create strong agencies, attract top-notch men, and get budgetary support for both. It remains to be demonstrated that this is so.

In the European countries, certainly in the period immediately after the Second World War and probably in many of them to this day, there are two tendencies that are not duplicated here. One is a sort of respect for special training and intelligence. Secondly, there is a definite feeling for land as a natural resource as opposed to a speculative commodity.

These two tendencies go a great ways to help the growth of strong agencies, to attract powerful men, to finance these agencies, and to gain general acceptance for them. We in the United States seem stuck forever with con-

sumerism and selling. Perhaps the National Institute for the Building Sciences, which has been proposed so often, is one step in this direction.

I am deeply troubled by these large and somewhat shapeless questions and I know they cannot be disregarded. Currently, I am off on a research project to try and find out what I can do about several of them. If any of you have any ideas, please let me know. I shall be trying to find out what has been happening within our government agencies and projects. Already, we have quite a collection of examples of state legislation which cheerfully says, do anything you can for the industrialized production system, and cheerfully disregards the implication of what might happen as a result. (Laughter.)

I shall also seek out the extensive experience of European countries. I am sure that, at least in the quiet of back rooms, important guides and warnings can be transmitted, and we can get substantial benefit from them.

So much for the U.S. situation with respect to systems building. Typically, we are making all sorts of efficient, local progress in what may well be very wrong basic directions. Such is the view from the ivory tower.

THE TECHNICO-ECONOMIC STATE OF BUILDING IN EUROPE

GERARD BLACHÈRE
FRANCE

I have heard that you are pinpointing the problem of introducing industrialization into building as not merely a problem of technology. And you are wondering what sort of experience we Europeans can offer. You may possibly go so far as to wonder whether we have any experience at all, because when we come to the United States we prefer to talk about methodology. We talk a lot about methodology because we want to see it. But Europeans have had, and I am one of them who has had some experience in other aspects of the question-- for example the underlying structure of the professions involved in building, including finance, administration and social environment. I am not sure if this is what you call "software".

In Europe we have had quite a number of panels of experts, working groups and roundtable gatherings, focusing their attention on these questions. Results have been many papers and resolutions, and even some decisions on the part of ministers and the Government. You are certainly aware of the fact that a sort of industrialization of building actually exists in Europe. But, because the circumstances are different from those in the United States, I prefer to present you with principles.

My first point is that the necessary conditions for introducing industrialization depend on the sort of industrialization you try to introduce. Several kinds of industrialization are distinct from one another because of the selling and producing methods employed:

- production on receipt of an order;
- a "mecano system" with the producer issuing a catalogue of components that fit together, but not with components from another system;
- buildings listed in catalogues-- akin to the motor car catalogues;
- the so-called "open system" with extensive or exclusive use of industrialized components produced by a great many firms independent from one another.

The different sorts of industrialization are distinct also because of the size of the series-production needed in order to remain competitive in terms of cost. The size of this series-production in turn depends upon the kind of production technology employed.

To give an example: It is feasible to set up a large concrete-panel producing plant in any city of over five hundred thousand inhabitants in the United States, or anywhere in the world. An output of one thousand dwellings a year is a reasonable requirement for such a plant; and within the area of a given city, one is unlikely to encounter more than one, or at the most two or three different building codes. In any case the methodology used is flexible enough to satisfy the various codes. Also it is not unreasonable to anticipate the realization of contracts for a total of one thousand dwellings a year, with each contract valid for construction of one hundred dwellings units upon receipt of an order. That is on the basis of various designs submitted by various architects.

Whether or not one makes or loses money is a separate problem which depends on the relative cost of labor "in situ" [on the site] and in the plant; and also on the price proposed by competing methodologies. This aspect of the problem is common to any industrial activity, leaving aside the problem of unions.

Perhaps some of you consider that large concrete methodology has nothing in common with industrialization. In that case, may I substitute "industrialization as you imagine it to be", because, as I see it at least, large panels do represent industrialization: that is to say, building without the use of traditional skilled labor.

Cast-concrete technology is, indeed, industrialized technology since it makes possible building without employing masons, carpenters or joiners. Instead, more or less sophistocated moulds and machines are used.

If, on the other hand, one tries to sell catalogue houses, he needs-- on the basis of existing experience-- a market the size of a region. This introduces the difficulty of coping with the many different codes and standards in existence in the selling area.

This difficulty is encountered in European countries, though not in France. As you probably know, we had a revolution is France almost two hundred years ago. One result was the introduction of a robust, centralization plan which in the course of time has saddled us with certain disadvantages but also some advantages. Thanks to it, we have been able to enjoy for many years the benefits of a single building code, applicable throughout the country, and a single set of standards.

In other European countries it has not been such smooth sailing. You may be astonished to learn that in Switzerland with its five million inhabitants, there are over two thousand two hundred building codes. That is an average twenty times higher than in the United States!

In Great Britain the number of code-enforcing authorities is more reasonable, about thirtysix. Even this is enough to cause problems for industrialists. The solution has taken the form of guidelines emanating from the National Building Agency with respect to catalogue houses and systems, as well as agrément by agency boards for components. Both the advice given and the agrément are valid throughout the country.

Even we, the French, are conscious that we shall be encountering the problem of multiplicity of codes in the Common Market. But we do possess counter-ammunition in the form of the European agrément, which is operational in all Western Europe with the exception of Scandinavia. With regard to building codes, we actively support the so-called "réglement exigentiel", which might be roughly translated as "performance code". It is, in fact, a code based upon the satisfaction of users' requirements. The French code today is largely "exigentiel" or "requiremental", and also very short. We believe it is the only way to make it likely to have the same building codes and rules adopted by the various states or countried concerned. Into the bargain, this sort of code is the best one suited to technical progress.

My second point is that it is essential not to forget the importance of hardware when studying the process, or software. In France, too, there are perpetual cries aimed at countering barriers to hardware innovation. A great many meetings are held to discuss the question.

For example, in its previous form, the unified building code was too restrictive. Among other disadvantages, it tended to curb the genius of inventors. So we substituted a requiremental code. It has since become clear that what hindered invention was the lack of imagination among the designers.

It is possible that, up to a point, the situation in the United States is somewhat similar.

The most serious barrier to innovation is the cost barrier. The bulk of new technologies which have failed over the past twenty years have failed on account of the cost barrier. I can claim to be able to invent a new building system almost every day. What I cannot do it to invent one which will stand up to competition.

Just look at the mobile home. When examined dispassionately and in the clear light of day, if it jumped a lot of barriers it is because here was production of a square meter in one and a half hours of non-skilled labor time, or one square foot per ten minutes of non-skilled labor time.

It is quite clear though often forgotten, that cost-cutting methodology has a better potentiality for jumping barriers than one with no spring in its bottom. However, the breakdown of costs is evidently not the same from country to country, and will not remain the same in the future. Consequently, what is good for Europe is not necessarily good for the United States. On the other hand, such methodology which is too expensive now can become competitive tomorrow, as a consequence of the undesirable rise in the cost of labor.

My third point is not far removed from the previous one. When introduction of industrialization into building is proposed, in any country you may wish to mention, opinions are expressed at once by many economists, university profes-

sors or journalists, who may not be sufficiently competent to discuss building problems, to be aware of the restrictive nature of the absolutely essential durability of the building, and of the costs involved. These "critics" are more enthusiastic about solutions which appear to be industrialized because metals, plastics, plates and fibers are used-- or solutions which can be said to belong to the world of architectural fiction. They refuse to grant that wood or concrete can be used in industrialized building. Can this be put down to pure romanticism?

Similarly, is the the belief in "a priori". For some, industrialization is only found in factories -- a belief held in the United States because of the ratio of cost of labor, on the site and in the plant. For others, no salvation is possible save in three-dimensional modules. Et cetera.

I take the contrary view: I say, "No religion." You must believe in fact, and in facts alone! The fact, in this case, is the fact of cost.

The precedent factors give rise to mental reservations which can be designated "the mental barrier".

The environment of the building industry is not made up of barriers only. We have aids to circumvent the barriers. The nature of the possible aids varies with the administrative and financing systems operating in the country. As an example I will introduce you to the aids we employ in France.

Some aids are financial ones which are well-known. For instance, credit facilities are made available to innovative contractors or manufacturers, in the form of low-interest loans, or loans repaid only when the innovation is completed, successfully.

More original, I think, are non-financial aids. One of these is the creation of reserved sectors, or "breeding grounds". Any financial authority is empowered to decide that a proportion of the credit is to be reserved for building by means of a given technology-- say, large concrete panels or light-weight mecano (a system we apply in our school buildings); or any system taken from a list of labor-saving methodologies, (for example, housing in 1955). Thus, while the element of competition among a limited number of firms is preserved, aid is given to the launching of a new technology. In principle, no financial advantage can be obtained because prices quoted by protected firms should be in line with those in force in the free building market. After a certain number of years of protection, the normal play of competition is restored by withdrawal of the protection.

Another form of aid which may appear obvious is the launching contract. It is the upper limit of the reserved sector in its most advanced form. It came about in France with the world-renowned "four thousand dwelling contract", when the French Government contracted with a private firm, CAMUS, without putting out tenders [bids] beforehand.

Yet another form of aid is the "granulometry" of contracts, or the marrying-up of the size of the contract with the needs of a given technology. By giving a priority to loans for large operations, such as the building of more than six hundred dwelling units in a single operation, the French Government gave an advantage to the use of large-panel (concrete) technology.

Another sort of aid is the possibility of public agencies to contract with a contractor on the basis of a program, or a sketch and not necessarily a completed design. That is, early contracting. This is necessary for the use of really new technologies, which no single architect knows.

All these aids and inventions were relatively easy to put through in France because a very large proportion of the financing of social dwellings is borne by the national budget; and because social dwellings constitute over two-thirds of all buildings erected in France.

You may well understand that such powerful aids to industrialized building in France in the Fifties did not escape some misuses. Initiatives of this nature are accompanied by many efforts to obstruct their success, bred by customs, habits, and professional interests. It requires a courageous government to attempt to pull down such barriers! Any government attempting such a task needs to be successful, or run the risk of being turned out of office.

At that moment in time, despite the high price (risk) involved, government ministers and civil servants nevertheless gave industrialization to our country-- and by extension, to the whole of Europe, which got the benefit of our efforts without bearing the risks.

In summation, I repeat what may be more or less obvious to you:

-There is no hope for non-competitive methodology to negotiate any barriers, or to succeed after the barriers have been removed.

-Avoid "a priori"-- any sort of industrialization is valid when it proves to be competitive, and does not employ skilled labor.

-The most effective technology is that which has to remove the least number of barriers and requires the least amount of aid.

-Finally, it is helpful to keep the code-barriers and standard barriers down, and to provide a common awareness of innovations.

BUILDING CONTROL: SOME NOTES ON METHODS, WITH PARTICULAR REFERENCE TO BUILDING REGULATIONS IN THE U.K.

JACK GARNHAM WRIGHT
U.K.

You might consider that it is a very good thing that I am limited in time when I have to talk to you about a subject like building regulations. There may however just be time to impress you with the idea that the subject is of great interest, being concerned with where social and technological affairs meet, or even clash together; and of quite crucial importance when there is a need for higher productivity in building-- for which systems building is but one solution.

In the first case, there is a greater need than ever with this subject for me to define my terms. Always, in trying to explain what building regulations are, I am reminded of the three men who were put in the dark with an elephant, and asked to describe what it was. The first felt the trunk, and said it was like a tube; the second, an ear, and said it was a fan; and the third touched a leg, and said it was like a column. All were both right and not-right. And I must hastily add, before anyone constructs an eastern concept of logic that undermines Aristotelian philosophy, scientific positivism and consequentially the basis of all building regulations, that they were not-right in the sense of not having grasped the whole truth. One can recognize their difficulties. The same thing seems to happen often in the full light of day, when erudite professionals talk about building regulations. They might claim to qualify for sympathy, that an elephant is a good metaphor; it has a long life deriving from obscure origins, is cumbersome, and possesses a long memory. [Laughter.]

Building regulations in any country are a product of the prevailing social and technical conditions, so it is important to stipulate that we are talking about regulations and their future in the context of our own national development. They represent the minimum acceptable standards of performance, which society sees fit to give the force of law, for its built environment. They state what the public needs of its buildings, which must also be what its industry can provide economically. Their making is a complex creative are, which, together with their subsequent administration, depends for success on a proper balance of theory and practice. Their development is related to the national level of sophistication in social and technical affairs. To interpolate their future, we should explore their past and consider both the legislative technique they have adopted and their technical content.

The Legislative Techniques and their Origins in the UK

The three legislative techniques employed in the UK have been described in the first report of the Building Regulations Advisory Committee. It is perhaps typical of an English legal instrument that all should be currently deployed, representing in effect the past, the present and the future, leaving a choice to pragmatism. Their simultaneous presence in one harness has not necessarily been the result of any conscious theory.

Bye-laws, on which the regulations were based, followed in the wake of the industrial revolution, giving evidence of the changing social philosophies. There was a growing recognition that the dreadful hazards to health in the typical urban situations were caused by physical conditions, which could, after all, be controlled or at least modified by the effort of man. The thought that "our remedies oft in ourselves do lie, which we ascribe to Heaven" was beginning to affect the public consciousness. The need to translate it into action became more urgent as the population explosion, and the shift of the rural population into towns, attendant upon the change in methods of production and the adoption of new forms of energy, made the dangers of overcrowding critical.

Those first regulations dealt with crude and basic dangers to health and safety. They were made for a building industry on which the technical revolution had had, initially, little effect. The law was concerned with long established technical habits that showed no perceptable change. The traditional methods of training for the craft-based industry, operating through families and guilds could not be expected to keep pace with the accelerating demand, so that, although there was an elite possessing craft skills of a high order, the general level of competence would be low, at a time when universal suffrage and general education were yet to be achieved.

The three techniques described:

A. The Specific Requirement

In this situation the legislative technique of the "specific requirement" was apt. It meant the bye-laws described precisely what must be done, without specifying any aims. These were perhaps implicit: namely-- the buildings themselves should be constructed safely so as not to collapse, and the dangers emanating from their normal use should be kept under control. Given that the structure itself was safe, there were two main hazards caused by the occupational use: the disposal of refuse, and the use of solid fuel to provide warmth or energy. One was an obvious menace to public health; the other provided a constant threat of fire. Plagues and conflagrations had both been renowned scourges of urban life since towns began. So in the public interest it was necessary to spell out the kind of specifications for the materials and structures that would mitigate such dangers. The builders could simply do what they were told without having any need to ask why. The authorities enforcing the law, who depended on the same level of technical competence among their employees as the builders, were able to check that the regulations were complied with by the straightforward process of comparing the built product with the physical criteria of the controlling specification.

The result was a legislative method fitted to its purpose as a definition of means that made construction and compliance practical, at a time when the industry it controlled was, by modern standards of change, technically static.

Its effect:

Once this system became firmly established, it had the effect of making technical experience public, (not exclusively a guild prerogative), and of focusing attention on the process of industrial development through recorded experience. From half way through the Nineteenth century, the process of checking built constructions against the crude legal specifications became customary.

By the turn of the century, manufacturers could come together to agree on how to standardise materials and methods where their most extensive experience had made relevant facts very familiar. The time was opportune for creating a national institute for promoting industrial standardization, and so for providing an official framework for the manufacturing consensus. This was the British Standards Institute. It was a natural sequence of events, perhaps, that the industrialists made the standards, with the consumers exercising very little influence beyond the remote one of having set off a train of events with the original legal criteria designed to achieve implied but elementary standards of health and safety.

When, two decades later, the first building research stations was founded in the UK, its research activities were mainly to do with the familiar physical problems and structures, and it was able to give the hitherto empirical knowledge the stamp of an authority based on objective judgements. Not long afterwards, in the next decade, the central government was able to prescribe a set of "model bye-laws". In doing so, it was taking a further step to standardise means, by encouraging the many local authorities to adopt the standard criteria.

B. The Functional Requirement

Its benefits:

In this context, specific requirements began to be anachronistic, and the technique of the "functional requirement" became practicable. It was desirable too, because the building industry was being affected by the technological

try was being affected by the technological changes whose pace was perceptibly increasing. Indeed byelaws prepared in the Thirties stated that "the present time is seeing great changes in building methods and materials. Local byelaws should be adjusted, as the model byelaws are adjusted, to keep pace with these...". The same statement mentioned the standards institution for specifications of some familiar materials, and advised reference to the research station where a material or method is so novel that there is neither a national specification nor general practive to serve as a guide". Legal instruments clearly needed more flexibility than was provided by the existing technique of describing the established means. The time was propitious for the law to define its aims in very crude terms. In the first model byelaws, specific requirements were stated for the traditional materials, but "all other materials" were required to be "of a suitable nature and quality for the purpose" and "adequately mixed". Later editions were soon to claim "The new byelaws are specifically designed to allow the utmost possible freedom in building methods provided that the functional requirements are satisfied". Relying more and more on national standards and on the in-put of research, the instruments required that all materials must be "suitable", structures "capable of safely sustaining loads", and some aspect or other of performance "adequate".

Its disadvantages:

Hindsight reveals the obvious disadvantages of such a system, which still apply. Neither the enforcing authority, nor the designer or builder were told in law what was suitable or adequate. Guidance was given, but it was for the enforcing officers to decide on the appropriate conditions what could be accepted. Clearly requirements could still vary in ration to their number, a factor not conducive to standardisation.

The system depended (and still does) on a higher level of technical competence than was needed for the administration of the "specific requirement" method, and also on a widespread understanding of what was needed in practice to fulfill the latter. But, so long as the standards for products were defined mainly by the producers, factors of safety were likely to be influenced by their commercial stake in maintaining a high quantitative level of selling; and so long as individual enforcement authorities were responsible for the determination of what was safe, factors of safety were likely to be higher than necessary, because wide margins make assurance doubly sure. It was not a combination likely to achieve maximum efficiency and productivity.

Its history retraced:

The presence of the technique of both specific and functional requirement in the existing regulations makes the development of the latter easy to detect. The present instrument shows that where there is not a body of established experience, the functional requirement is backed up by "deemed-to-satisfy" guidance consisting of a catalogue of the long-established specific requirements. Where there is a body of experience, the guidance comprises standards or codes of practice.

It can be seen that at first came the description of the means, then a recognition in crude terms of what were the ends. These "ends" were then embodied in the law as functional requirements, with the established "means" re-stated for guidance. As experience grew, and was reinforced by research-informed consensus, it was recorded in national standard specifications and recommendations for good practice, whose main intention was to encourage a standardisation of products and methods in industry. It became possible to replace the use of the specific specification in the "deemed-to-satisfy" guidance, by reference instead to these national records or experience.

The result is a proliferation of the words needed to describe what is meant by the law.

Its effect on research:

The system has merits in a climate of comparatively slow but accelerating technical change. The vague statement of "ends", in terms of function, allows, at least theoretically, a desirable flexibility about what "means" are appropriate. An additional advantage is that there is an established route for the transference of research knowledge to general industrial practice. So long as expenditure on research and the size of research projects remain modest and promoted largely by industrial interests, the research information can be directed to improving standard specifications and recommended practices, and since these are held up by the statutory instruments as examples to be followed, the law has the effect of promoting the adoption of research findings. Of course, while this route proceeds through channels controlled by producers, it is subjected to economic constraints whose boundaries are practicability and profitability; and while the research effort concentrates on the physical problems of materials and techniques, it can contribute to industrial efficiency; but the consumer-- that is, the purchaser and user of the built environment-- might conclude that his needs are at least stated in law as ends, no matter how vaguely; but as regards the means and the qualitative standards, he has to take what he can get from what he is offered.

A further disadvantage often referred to is that a regulation couched as a functional requirement cannot be relaxed, or indeed modified to keep abreast of events. That which is required to be adequate, must remain adequate. To relax would be to accept inadequacy. Meanwhile, the multitudinous array of codes and standards used as guidance for adequacy, are changed piece-meal, causing a continuous problem of amendment and interpretation.

C. The Performance Standard

In an industrial society, social affairs can be expected to benefit from progress, along with technical developments, so that an increasing consciousness of social justice should lead naturally towards a system of legislative control that deals more equitably with consumers' needs. At present there seems evidence of this is the introduction of the "performance standard" as a tool of the law. In referring to it this historical review comes abreast of contemporary events. The BRAC first report (1964) in the UK explained this new regulating technique as "defining in objective terms (usually on the basis of applied research) the performance required, and making the attainment of such performance the actual requirement in the Regulations"; pointed out that "such a form of control gives freedom to the designer to achieve the performance in the way he considers best, and also gives the measure of the performance which is to be achieved"; and claimed that "clearly performance standards are the ultimate objective", while admitting that there were "few at present" in the regulations.

Its problems and implications:

The successful adoption of this technique is more than ever conditioned by industrial skills and technical sophistication. The advantages can be readily agreed. The ends-- that is, the consumers' needs-- are precisely defined by the public as user for the benefit of the law-enforcer, the designer and the producer. These can be amended as standards change, without difficulties in interpretation, and relaxed in particular cases where different standards may be acceptable.

The difficulties are equally apparent. There are three main problems. It is necessary firstly to identify and establish the appropriate standard; secondly, to have in common use such well-understood design and production practices that can predictably embody the stated aims in the completed product; thirdly, to have standard testing facilities available so that the results can be confirmed on behalf of the consumer. Although the second problem must be solved by an extension of the industry-oriented type of research, the emphasis of control shifts significantly from supplier to consumer, whose influence must govern both the statement of standards or the legal design criteria; and the tests of the industry's compliance with them.

In stating performance requirements, society as consumer has come full circle, in a hundred years of industrial development, from an implicit to an explicit statement of aims for its construction industry. In so doing, it determines the new goals which guide the production of means. The solution of the attendant problems lies increasingly with science. The burden of research must shift to consumer sponsorship. It is needed on a hitherto unprecedented scale; in the human sciences to establish the user's standards for the built environment; in the already well-developed applications to materials and practices, to help establish predictable means and reliable tests.

The pattern is perhaps already emerging in the UK's research programmes, and in the tendency towards user-orientation in its development work for building programmes. The rationalised methods of increasing building productivity in the UK have been strongly influenced by user-requirements, and provide a reasonable oppor-

tunity for adjusting national methods of control to fit the social change of emphasis. Before following-up these clues to the future, however, it is as well to be reminded of a point made previously: that the successful making and administration of building regulations depends on a proper combination of theory and practice. It is no good prescribing standards of performance, excepting as theoretical targets for social and technical development, if there are no means of achieving them economically in practice. It is no good giving them the force of law if there are no reliable ways of testing compliance.

The Future: A General Review

It is with this reminder that I would like to turn from the self-imposed task of trying to identify the coordinates of past and present practice from which to project the future, to the task of prophecy. If I seem to have established my coordinates with what appears to be a form of subjective dogmatism, I can only defend myself on two counts: firstly it has always been the traditional and prevailing habit of prophets-- and it seems churlish to try to be exceptional; secondly, it is a form that is a co-descendent with science from the first principles of western philosophy (now available in popular paperbacks), because, as Dr. Erich Fromm explains, the idea that truth can be found in thought leads to both dogma and science.

The urgent need for a guiding theory

There has been no time like the present for thought to be directed to the future development of regulations. Industries are facing up to new social demands, for mass production and for better environmental conditions. It is a time for the definition of a clear conscious theory, for two very important basic reasons, both related to the rapidly developing pace of social and technical change.

The first is that the building, as an end product, is being taken rapidly further away from the control of the individual consumer, because the great increase in the demand for buildings is forcing the pace in bringing into use the industrial processes needed to achieve a matching output. In the new industrial society generally, according to Dr. Galbraith, the market is eventually no longer effective, and is replaced by planning. Buildings are unusually large consumer products. By the time the individual purchaser comes to place an order for the commodity, the industrial process of production has, so to speak, long since started up. We are getting past the time when he could exercise control through his agent, the designer. The scope for choice is constantly reducing. He is like a customer choosing a suit, who has to select from a range of manufactured cloth and perhaps an established choice of "cuts": the tailor merely providing the final fit. The building-production process has become national in scale, so that if the consumer is to have any control, it must be exercised at the community level, through some democratic national agency of the public client, that can direct the design-aims and the product-quality of the building industry as a whole. Legislation is the means to this end, and national building regulations the appropriate medium. It is a matter of urgent importance that this kind of consumers' agency is given adequate authority and strength, and is properly suited to its task, because the highest priority has been given to productivity in the industry. It is wise to get the commodity right before mass-producing it.

The second reason is the related one; that there is evidence that the pace of administrative and legal change is always outstripped by developing technological competence. The relationship is like that of Reason and Energy in Blake's Marriage of Heaven and Hell. Industry supplies the Energy, and will claim in its irreverent way that no matter how heavenly the legal administering authority, its archangels of Reason seem to produce an inertia, resisting change. To give the devil his due, we have seen how "specific requirements" may remain in use, especially in large conurbations, long after their purpose has been served. By the same token, it is possible that words may remain in use for the definition of the law long after other modes of expression, like the mathematical binary scale, have replaced them for the design and productive processes they attempt to control. In consequence, we need to think a long way ahead.

The need to change legislative techniques

Perhaps it is right then, to give first mention to the future development of the legislative techniques. The change to its use has already begun, so we should be mainly concerned with the question of forecasting the time-scale. Projecting from the past, it can be seen that major events in the development of building control and guidance, since the inception of the first legislation, have occurred on a scale of reducing intervals. These could indicate that the full change to the performance standard is to be expected in the UK within a decade from the creation of the new regulations in 1965.

The difficulties

There are four main difficulties-- one administrative and three technical. What are they, and how soon will they be overcome?

1. The administrative problem

In the first place, how soon will we be able to have the "high level of technological competence to administer performance standards" for what is thought may be a "costly process-- alike in time, scientific resources, and administration"? There are signs at least of events that will result in the qualitative and quantitative improvements implied. The output of trained personnel from the new technological universities and colleges will contribute, and attention is already being given to the problem of training for enforcement work. If local government is rationalised into larger regional groupings, as seems likely, the opportunity will exist for attracting the skilled personnel to the work in appropriate numbers. There seems no reason to believe that sufficient improvements will not have been made in less than a decade.

2. The technical problems

The technical problems have been mentioned previously: the need to establish standards; the need for reliable design methods to embody them in buildings; and for testing facilities to check that they have been provided.

A. Research: All require more research and the deployment of larger scientific resources. There is the indication too that much of it should be a new consumer-oriented type of research. Will this be available in time?

There are several signs to postulate an answer. As long ago as 1964 the need for more research for the construction industry in the UK was identified in the report of a government working party, which claimed that current research spending represented 0.2 % of the net output of the industry, or 0.3 % of the associated annual output, compared with 2.0 and 2.7 % for other industries, and concluded that the "level of expenditure on building research" was "disproportionately low". The report showed too that research on user and physical requirements at the Building Research Station accounted for only one-fifth of its expenditure, the main outlay being on materials, structures, soil mechanics, building operations and economics, and mechanisation.

The identification of a need is often the first step towards its being satisfied. Whether the expenditure of research activities will have reached the scale needed in less than a decade is a good question to leave open. Perhaps I have misread the constellation of past events on my scale of reducing intervals, and that the event heralded within the next decade is not the wholesale transference of the regulations to performance standards, however desirable that may be, but the creation of a consumer research station as part of the expansion of scientific resources; to be followed in its turn by the adoption of performance standards at a further, correspondingly reduced, interval.

B. Design methodology: It does seem possible that the balance of attention has already increased in favor of research topics dealing with user and physical requirements, and certainly much weight is given to these in academic circles. There, too, a great deal of effort is being devoted to design methodology, which is to do with our second technical difficulty. There are two clear indicators to its being overcome in good time. The first is the increasing use of scientific methods in teaching design subjects; the second is the expanding work of client-consortia in bringing into use rationalised methods of construction. The systematic use of ranges of components for building improves the predictability of the performance of the designed product, because the feed-back of information from the product-in-use can readily be organised to improve design. There is much evidence of this in the now well-established school-building consortia.

C. Consumer facilities for testing: There seems no reason to suppose that the introduction of performance standards will be held up for any lack of parallel improvement in design methods. Can the same be said in respect of testing facilities? Here the omens are both favorable and foreboding. There are many signs of effort being made in the development of scientific systems for testing, and in the development of academic theories for assessing the performance of buildings. Standard methods of testing are coming into use, like the "MOATS" developed for the [French] Agrement Board, which may well result in producers being able to subject their own products to a certified test. Machines like those used for stress-grading timber are being invented which enable products to be tested, classified and marked accordingly. But these developments at the moment seem to arise from the energy of industry, and can be of doubtful advantage to the consumer if the test pre-dates his definition of a standard. For example, in the absence of a standard of performance for materials which deals with durability, industry might be disposed to make up its own mind about satisfactory life-expectancy so that tests of materials can be calibrated.

In 1967, for example, the "Union Europeenne pour l'agrement technique dans la construction" agreed to a "durability in the order of fifty years for the main structure, twenty to twenty-five for coverings, and ten years for thin flooring". This has ominous overtones of product control, and portends a dismal future where all components will last only for such periods decoded by the manufacturers, no matter what the customer wants. It can be deduced from this, readily enough, that scientific resources and testing facilities should be available to the consumer, as a tool of the law, and not left exclusively to the industry. Of course, systems like the stress-grading of timber could bring benefits to the consumer, because they result in a more efficient and economical use of the material, and a predictable performance in use, based on a wealth of experience. Ominously again, however, the introduction of stress-graded timber has been opposed and delayed by an industry influenced by its established customs.

The trend towards performance standards in use

So much for the difficulties attending the trend towards the use of performance standards. Indications are that they are being eroded as surely as the new technique gains ground. At this point it is interesting to conjecture which topics in the regulations will be the first to be affected. Precedents leave the choice open. On the one hand they can show that the first effective use of a new regulating system will be for subjects where the most knowledge is already established from theory and practice, on the basis that the most experience has always produced the earlier gains. Evidence of this is clear enough: the parts dealing with materials and structures were among the first to adopt the functional requirement; and those dealing with fire resistance, which has been a subject for ordinance "almost from time immemorial", have been among the first to adopt the form of control by performance standard. Alternatively, the precedents can support the theory that the larger the body of established practice, the greater is the resistance to change. If, however, experience is the deciding factor, the parts dealing with materials and structures should be affected first by the next metamorphosis. There are plenty of good reasons for this, in particular because of the rapid advance of technical knowledge, and the use of new materials.

It isn't as easy as many may think, at present, to introduce new ideas. For example, the use of the functional requirement results in a building being presumed safe if certain established practices are followed. These guide the judgement of the enforcing officer, even if, as in the case of the regulations dealing with structural stability, they rely heavily in fact upon the skill of the structural designer. If, however, a designer is clever enough to use, for the benefit of his client, a new method not included in a Code of Practice, he risks rejection of his scheme, and formidable delays to the contract. It would be a brave, even foolhardy enforcement authority who would alone sanction such departure from normal, however necessary for technical progress.

But to disregard the system of functional requirements would be to cease to rely on the codes and records in which industry enshrines its established habits. The prospect may well be unbearable; so if established practice is paramount in laying change, then the regulations dealing with the subjects backed by new knowledge but less experience (like the provisions for environmental conditions), will be the next to change. It is significant that the existing requirements for thermal insulation, perhaps the newest subject, are expressed as performance standards.

The effect of a wholesale adoption of the technique of the Performance Standard

The effect of this change to the "performance standard" form of control will be far-reaching. A corollary will be the great reduction of written material now used in describing the law, and a consequential simplification of its complexities. Hitherto, simplicity has been gained in the specific requirement at the expense of flexibility and technical progress. The adoption of the functional requirement produced only an illusionary brevity. One of the shortest regulations dealing with structural stability, seems to cover a complex subject in remarkably few words, but only be making formal reference to no less than twelve codes, standards, or reports (drawn up incidentally for a different purpose), each a separate document in itself and each in turn making reference to extensive lists of others. It all seems to add up to a "thousand twangling instruments" of law, showing "riches ready to drop upon" the unsuspecting user, who only wants to know the law's requirements. The performance standard will herald a real return to brevity. The description in the law my be longer, but they will be self-contained. They will grow shorter and shorter as more tested data becomes available. The reduction in the total use of language will provide a much wider coverage in more precise terms, like the law of relativity.

The relation of the new style regulations to codes and standards: a new apparatus for industrial management

A most important consequence, however, will be the new lease on life for standards and codes. Relieved of being shackled to the instruments of law, these will be free to develop their true functions, and in concert with regulations will perform a vital role in the new apparatus of industrial management. Because the regulations will specify the performance required for the built environment, in all its aspects, national industrial standards will be able to define the consequential requirements of performance for each part, in terms of current industrial capabilities, accompanied by product specifications which will define what must be done to achieve that performance in each component by methods based on confirmations by standard tests. The development is already augured by such changes as the extension of the terms of reference for one of the technical committees for the British Standards Institute, which has been introduced with the preface "that product standards and codes of practice will need to be supplemented by a new type of British Standard covering performance criteria over elements having similar functions in building. These new standards would form base standards against which industry could design new products, have them tested and prepare product standards very much more speedily than in the past."

Together with the new building regulations, these new codes and standards will form a more consistent system to achieve the "attractive theoretical advantages" hinted at by BRAC. It could be an unsurpassed method of control, uniquely suited to consumer protection and industrial progress. The system would work like this: the regulations would define the minimum acceptable standards of performance for buildings; industrial standards would reflect a range above the minimum that could be achieved economically in normal practice; the codes, prepared mainly under the influence of theorists, would continue to recommend good practice aiming at higher levels of achievement. These would tend to set the pace to improve industrial standards which in turn would play a positive part in raising the minimum standards defined in law.

Safety in the new context

Ideas about safety do not seem to have changed much since the inception of building legislation. The standards remain, but the hazards have multiplied, and are different in kind. Buildings comprise an increasingly complex array of structure, fabric and mechanisms. All are integral parts of the product, whose design depends on multi-professional team-work and "decision-making in conditions of total information and simultaneity". All the relevant criteria must be available in the regulations. The services supplying water and energy, insofar as they exist as part of the building, should be included. Electricity, gas and oil installations, to say nothing of possible future developments in energy-provision, are as much a part of the built

end-product as were the solid fuel appliances so familiar when byelaws were introduced. They represent other hazards to safety than the threat of fire, including extremes like explosion and radiation. The safety of the building as a whole must be dealt with as depending not only on the security of each individual part, but on the control of their interaction.

Health and its future implications

Idea about health have changed. Previously it was thought of definitively in terms of the absence of disease, and the law was preoccupied with the disposal of disease-bearing refuse. Now, increasingly, it is thought of in terms of the presence of well-being and the capacity for enjoyment, and the law must take account. It will become more concerned with the provision of light, clean air, warmth, the control of humidity, and protection from noise, glare, fumes, dust and other detractors from human health and comfort. Improving standards will ensure that amenities are regarded as essential to health. A rapidly developing awareness of the human condition, informed by medical research and scientific space-exploration, renders the consideration of environment more urgent. The level of knowledge gained from experience in providing suitable environmental conditions lags behind that gained from materials and strucutre. Hence it is possible to conjecture on a spectacular leap forward in safeguarding health through the control of environment, because there is less weight of established custom to impede change.

Evaluating the provisions

With the human sciences promoting a new awareness, a good deal of attention is already being given to the classification of the performance required of the built environment, in attempts to assess design achievement with a view to product-improvement.

The ultimate brevities

It is possible to divine the ultimate future for the administrative system of control which could be brought about in the distant future by the operation of such a system. We can assume that the law will eventually deal with conceptions of buildings as a whole, instead of governing the whole by ruling the parts. So there will emerge one simple statement defining the law, which will be at first a functional requirement for the building as a whole with deemed-to-satisy illustrations in the form of performance standards for its parts. The building will be required to be "of a suitable nature and quality in relation to its purpose in providing an environment for human use" or words to that effect. No other legal requirement will be needed. Ultimately, buildings as a whole will be given certified performance grades, so that the functional requirement will be replaced by a specification of the standard of performance for the whole building according to its use. The law will state no more than the performance grade required: the design process, using certified and tested products will be computer aided, and the production and checking controlled simultaneously by computers. Enforcement officers will certify computer check-outs on Wednesdays, and carry out the occasional random test on a built-product as a change from the long weekends in between.

More immediate prospects for building control methods

Coming back from this "most rare vision", (which man may be an ass, if he go about to expound) of the remoter future of perhaps another three decades, to look at the more immediate prospects, it is clear that because the legal instruments now effectively represent the national criteria for design, the regulations will become technical classification systems as to content, and tend to be expressed in the new language of systematic design which makes use of the electronic labour-saving devices essential to adequate information-handling.

The trends of technical change now come sharply into focus. Before any real technical progress can be made in developing the regulations, it is necessary to be explicit about the aspects of the performance of buildings that are covered implicitly by the historical provisions. A building is now a complex modern industrial product. Leaving aside whether it is desirable to legislate for productivity and amenity, it is necessary to ask what is required of it in the context of modern concepts of safety and health.

Once the aspects of performance are identified with adequate consensus, it seems likely that the use of techniques like value engineering will lead to a better balance of priorities between them. Legal provisions for safety, for example, can result in heavy costs in the final product, so their relative value must be properly assessed, as well as the degree of risk appropriate to each, so that expenditure on them in the product is sensibly proportionate.

Recapitulation

Before examining the immediate prospects more precisely, it may be an advantage to recapitulate the broad trends, as follows. It looks as though the regulating techniques will be adjusted to the context of the prevailing conditions of social and technical development, by reference to performance standards. The adjustment depends on the proper use of knowledge from research, and the deployment of an appropriate level of professional and technical skill. The legal, or design aims will be identified in terms of performance. These will be evaluated and balanced, each to its relative priority. Also the standard to be set in each case must be related to the prevailing practical level of attainment, and then kept abreast of development. Finally, the instrumentation will be made appropriate to its task: that is, it must use the language appropriate for design criteria in a modern industrial society.

A suggested plan of action to bring regulations up-to-date

These trends stated, it is possible to speculate in more particular detail as to their possible effect on the regulations as known in the UK, laying aside for this purpose, any questions of political or administrative conditions that may or may not be essential factors in promoting change.

1. The re-classification of subjects

At first, it is likely that the existing Parts would be rearranged. The rather quaint titles like "preparation of site and resistance to moisture" and "open space, ventilation, and heights of rooms" would give way to more accurate classification of aspects of performance, which would include environmental conditions and take account of all service installations. Along with the re-classification would come the introduction of a new and general provision dealing with the performance of a building as a whole, framed to allow the interaction between various component parts to be taken into account.

2. The first change in regulation technique

Next would come the elimination of all use of the technique of the "specific" in favour of the "functional" requirement. Those specific requirements still in use might first be changed to the status of the "deemed-to-satisy" example in support of a functional requirement, before being finally discarded.

3. The launching of research programmes

Meanwhile there would be launched an extensive programme of consumer research to establish appropriate standards for each aspect of performance supported by a parallel programme of industrial research to develop reliable design methods for achieving the performance, and standard test procedures to enable its provision to be checked.

4. The evaluation of subjects

Hazards to safety would then be redefined and the degree of risk computed so that a scientific evaluation could be given to precautionary measures. These would of course be related to the life-expectance required of buildings. It would be a feature of the regulations that there would be classifications of durability, with approvals granted for explicit periods and provision for re-application at their lapse.

5. The transfer to performance standards

As soon as the necessary information is available, the performance standard would be adopted for each new part, once it was clear that a level of general competence had been reached to permit the specification, provision and checking of appropriate standards. The new technique would be likely to affect different Parts at different times, and different grades of performance might be introduced for different geographical regions, not only because conditions vary, but because techniques and competence may differ.

6. The development of enforcement

By such time, of course, enforcing authorities would have been reorganised and redeployed, recruiting from new training courses, and firmly linked with a central authority responsible for creating and administering the regulations (both being continuing processes). There would have developed a new relationship between these activities, and the research and educational processed. Also the creation of the national standards and codes of practice would have been orchestrated to a state of harmony with the new style regulations.

7. The testing of compliance

There would emerge established methods for assessing the performance of buildings as a whole, and perhaps two main types of testing facilities: one working under government sponsorship and offering a service to the legislative and enforcement authorities for identifying standards and for testing or assessing the building as a whole; the other working in conjunction with industry to provide for the testing of materials and components against the prescribed requirements.

8. The language of the law

Of course, as soon as the first step is taken to reorganise the subjects covered by the regulations, the whole question of their expression would have to be re-examined. The regulations, as a national tool of management, must take account of the effective language of management-- verbal, graphic, or mathematical, or a combination of all three-- so that efficient design and production processes can be fully realised.

Consolidation

In any one country, of course, there will be no room for more than one set of controls for buildings, if the national industry is to achieve an equal level of output on an equitable economical basis in all of its parts.

The "wish-fathered thought" tells us clearly enough that the fusion of existing legislative devices into one national instrument need not be difficult, because the efficiency and obvious desirability of the mergent regulations, on the basis of such prophecies, and engendered by common experience, should overcome all objections. There would be a positive clamour for fusion. Neither will there be room for a cacophony of Acts dealing with the creation of buildings, though of course there may remain a number of incontrovertible fingers in the pie of their ongoing use and maintenance.

With this flurry of mixed metaphors worthy of any journalist sports commentator-- that doyen of pop-forecasting-- I doff the prophet's mantle, which, having been assumed in my own country (in more senses than one) can afford me no honour.

OPERATIONAL APPROACHES TO SYSTEMS BUILDING

CARLO TESTA
ITALY

CHAIRMAN DAVIDSON:

Carlo Testa is authoring at the moment a book called "The Industrialization of Building." I think I have heard that title somewhere before. He tells me that we are going to get a kind of preview of it.

So, over to Carlo, please.

Thank you, Colin, but actually that is slightly incorrect, my presentation will not contain the entire principle of the book, but just one of the subjects I am dealing with in the book. The subject is operational approaches one can use today in industrialized buildings. But before going to that, which is a very practical problem, a problem of dollars and cents, I have got to play a game, the game of definitions.

I am not perfectly happy with the definitions which have been given this morning and so I am going to give my own definitions which are much, much better. (Laughter.)

What is industrialization? I write it down because I tend to forget it myself. Industrialization is a process which by means of technological developments, organizational concepts, methods, and capital investment tends to increase productivity and to upgrade performance.

We have here two points to consider; productivity and performance. When we are talking of industrialization of buildings in Europe, be it in England, France, or Italky, in reality, we are only talking of increased productivity. There is very little improved upgrading of performance. Sure, we can do a building faster sometimes, very, very seldom we can even do it cheaper, but the performance is still the same.

To take an example: the rocket to the moon has an upgraded performance over an airplane; and the car has an upgraded performance over the horse-carriage.

I think the few cases where industrialization in building has produced upgraded performance, have happened in the United States, and I am speaking of schools. You can move your partitions, get a better climate control, achieve a flexibility which you couldn't by conventional method. To see the truth of this statement, try to tear down a brick wall, or try to reach 75-foot spans by conventional methods.

One of the big failures I consider in industrialization is the fact that we have accented productivity and have put no accent on performance. We are still doint the same product as before and when we fail with industrialization, this may be one of the main reasons.

We also have to consider that we can have industrialization by technology, we can have it by organizational methods, and we can have it simply by capital.

Paradoxically, it is possible to have industrialized buildings using bricks, by using a proper management approach, if we have an objective productivity and performance. It is not technology alone which gives us industrialization.

Now, if my definition can be taken at least as a basis for what I am going to say, the next question is: how many forms of industrialization exist? Obviously there may be thousands of forms, but I am going to explain four forms which are easily identifiable.

The first goes under the name of prefabrication.

(Fig. 1) You first design the product. Then you break it down in logical components,

Fig. 1

where "logical" is to be understood only from a production point of view. If you want to slice it as I have attempted in this case in a panel, the roof, some windows and door components, it is right; or if you want to slice it the other way around, resulting in vertical slices, again it may be right.

The point is that first you have got the design. Then you break down the design into components and you get the building which is always the same as the one you had designed.

The best example of prefabrication is the production of a carburetor. First, you design a carburetor, then produce the parts and assemble these parts; you always get the same carburetor. Sometimes you may bet a sculpture by using the parts of the carburetor, but that is really breaking the ruled of production.

Prefabrication follows different techniques and accepts different organizational forms, depending on the situation under which it is working: economical, technical, et cetera.

(Fig. 2) Now the second form of industrialization, and there is no hierarchy of preference in this order, goes under the name of modular building systems.

I am personally horrified that we use the terms "systems" or "building systems" for everything. Partially this is because when you use the word prefabrication, as somebody mentioned earlier, a morality committee will be formed to sail you out of the country. So, you tend to use the word system.

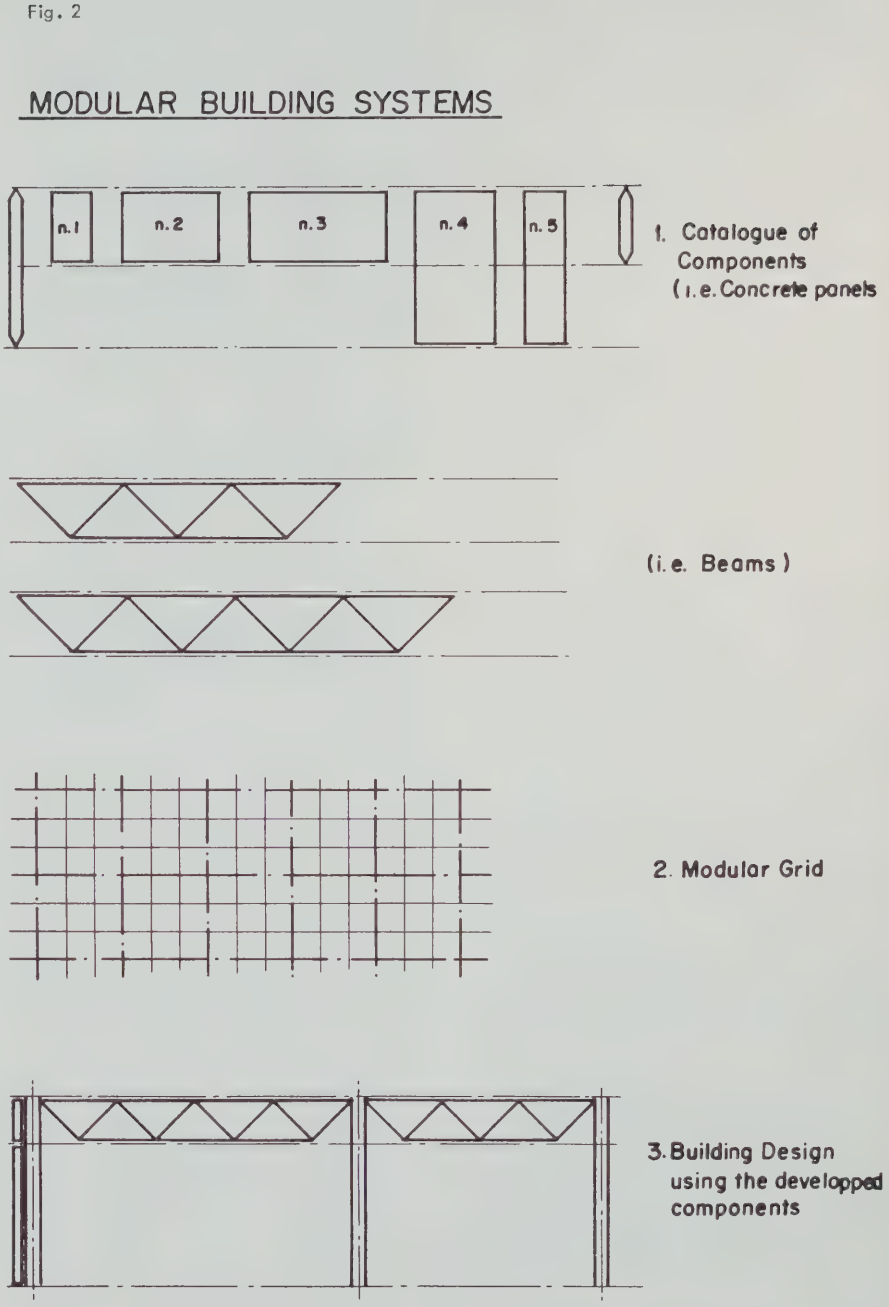
System is a meaningless word in itself. Any building is a system in its own right; whether it is done with bricks, mud, concrete, steel plastic, it is always a system according to the dictionary definition.

However, if we add "modular" to it, our understanding becomes a tiny bit clearer. What happens in modular building systems? You design a set of components. You design catalogs. These catalogs contain subsystems--the structural subsystem, the panel subsystem, the doors and windows subsystems, et cetera. Finally, you add a modular discipline which allows you to bring all the components together and achieve an infinite variety within a defined set of performance standards. Every time we design a modular building system, we have to talk of a universal system: that's a joke.

For example, if you take the CLASP system, you will always get rectangular buildings whatever you do. You will never be able to make a round building. You will only be able to go three floors and not to five, except if you modify your set of components.

So, there is pre-decision, a catalog of components, and then a modular discipline which includes geometric acceptancy of one component to the next.

Fig. 2



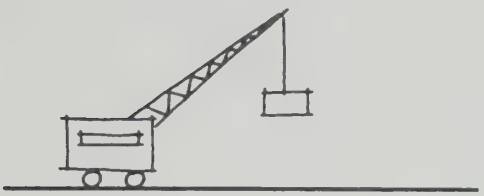
(Fig. 3) The third form of industrialization is extremely difficult to represent graphically, even if it is probably one of the most interesting; it can be called: rationalized building.

What is a rationalized building? I think the peak of this form of industrialization has been achieved in Germany and the Netherlands. It simply means putting the right man, the right kind of equipment, the right kind of material in the right spot at the right time.

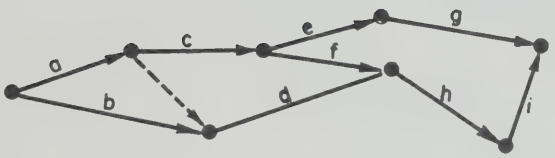
If you use modular building systems and rationalized building methods under the same conditions on a specific site, you may find that rationalized building goes faster and is more economical than modular building systems, provided you have taken into account all the costs: the investment required to develop a modular system, and the time and the administrative machinery required. We tried it once in Frankfurt and it did work that way.

Fig. 3

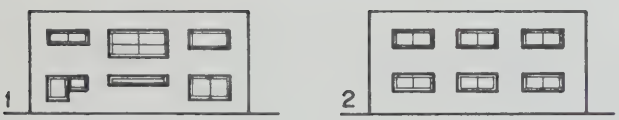
RATIONALISED BUILDING.



1. Correct Tools



2. Planning Tools



3. Design Simplification

Here is a list of thirteen activities which is enormously simplified and by no means complete. Even if they are in English, they don't mean the same thing in all countries:

Research
Development
Land Acquisition and Improvement
Building Design
Promotion
Marketing
Bureaucratic Services
Financing
Production Organizing
Production
Assembly Organizing
Assembly
After-Sale Service

First, we have research activities. By research is meant the basic research on material and performance, but also the preparation norms, bylaws, standards, et cetera.

Development in this sense is intended as technical development: the design of components or the design of discipline, how components will fit together. The development of a complete modular system or the development of a piece of equipment to produce something.

Land acquisition and improvement, I think explains itself. Building design is a classical activity in which architects have been involved.

Promotion. This term may be extremely misleading. The activity of promotion is the one done by the guy called the "Promoter" who at his best owns a suitcase and a good name. He goes from one place to another and finally

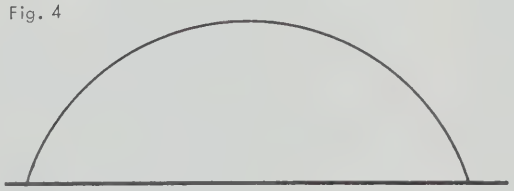
Obviously you can never extrapolate to other countries or other circumstances. The United States is probably a leader of rationalized building methods for big buildings like the World Trade Center.

(Fig. 4) The fourth form of industrialization is equipment intensive site production. This form is typical of the United States and curiously enough has been abandoned because it met with very little success.

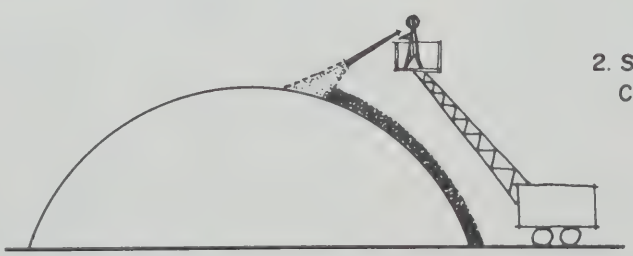
What do you do in this approach? You have got some kind of equipment here in this sketch. I tried to mimic the NEFF solution of 1940. You have the University of Michigan solution in plastic. You have earth molding. There is also one in Germany, the BASF domes. Under this form of industrialization you have one piece of equipment which is brought on the site which, with extremely little labor, can produce a shell or a subsystem.

Now, according to my definitions of industrialization, we have to consider which kind of activities are related to the process of building.

Fig. 4



1. Inflation of Mould.



2. Spraying of Concrete.

EQUIPMENT INTENSIVE SITE PRODUCTION

finds an island in the Caribbean and convinces the local cacique that if he could put up some beautiful hotel, he would make a lot of money. Then he gets a piece of paper signed by the cacique. He goes to a bank and convinces the bank that he has got an island in the Caribbean and if the banker puts in the money, he also will make a lot of money. And with this he goes to an architect and he convinces the architect that he has an island in the Caribbean and a banker and if he designs the hotel, he will make a hell of a lot of money. And finally he goes to a builder and he convinces this one that having this banker and all the other things that is an absolutely sure deal. When he has done all of these things, he has spent extremely little money except buying martinis and traveling from one place to another. (Laughter.)

And then he starts the job. If he is lucky, if the clients buy fast enough before finances catch up, he will make a hell of a lot of money, as will the other people with him.

Now, I have spoken of this in a way which makes it look like a very shady deal. But in actuality promotion is essential because it prepares the market without which you will never have any form of industrialization.

In addition, we have marketing which is the simple activity of pushing the product and peddling it to the clients.

Bureaucratic services depend on which country you are in. In certain countries it is absolutely necessary if you are going to sell anything, because otherwise a man would never be able to get building permits, electricity, gas, water, et cetera. This is a major activity, for instance, when we have to build a school in Spain.

Financing explains itself. Production organizing is the activity of scheduling the job production so it will not run amok as normally happens. For example, in school building, which is my field, it always happens that people want a miracle--that is, to have schools ready by September. (Laughter.)

If you produce all of your stock for September completions, you will have a peak of production, followed by nothing to do in the winter. This means getting rid of your people whom you have trained, and thus, quite a financial loss.

Production itself is a self-explained activity. Then we have assembly organizing which is the parallel activity to production organizing; the assembly; and that important and very often forgotten activity, after-sale service.

Someone said earlier that to insure that a system or a method does work, it is extremely important to be able to control what happens after you build it. In fact, if you provide that kind of service, you can take a lot of short cuts in your production approach: you can control the nondeterioration of the product afterwards instead of attempting to make the product perfect before it goes on the market.

One activity which does not appear in this list and which is extremely important for the United States is insurance. This list has been prepared in Europe where insurance is not so crucial; but anyhow the list should not be considered all-inclusive. You can add as much as you want to.

(Fig. 5) We have seen some 13 activities of the building process and we can now move to the problem of the operational approaches. How do organizations operate in the field of industrialized buildings today?

This analysis comes from the work I have done during the last 10 months. I have analyzed some 117 companies in the United States, England, Germany, Italy, France, Israel, and some other countries.

Basically, you can recognize two forms of organization: one which in Europe is called vertically structure organization; and the other, horizontally structured organization.

I use the word organization and not the word company because the "approaches" are valid both for profit-making and non-profit-making organizations.

The vertical structure. Probably one of the best examples of a vertical structure is National Homes in the United States. Here is a company which buys land, or at least did buy land, which does land improvement, produces the components, selects the builders, helps the builders do the marketing, assembles the building, handles the financing for the builders, et cetera, and which does a tiny bit of after-sale service. Everything is under one roof. Everything is controlled vertically by one organization.

In Europe we have similar organizations, not as inclusive as National Homes, but I think the French housing companies can be identified as vertically organized structures. Organizations such as Camus, Coignet, Balency, et cetera, produce, assemble, and sell to "somebody." They "sell to somebody" and this is their big weakness: they don't control the market themselves.

Fig. 5

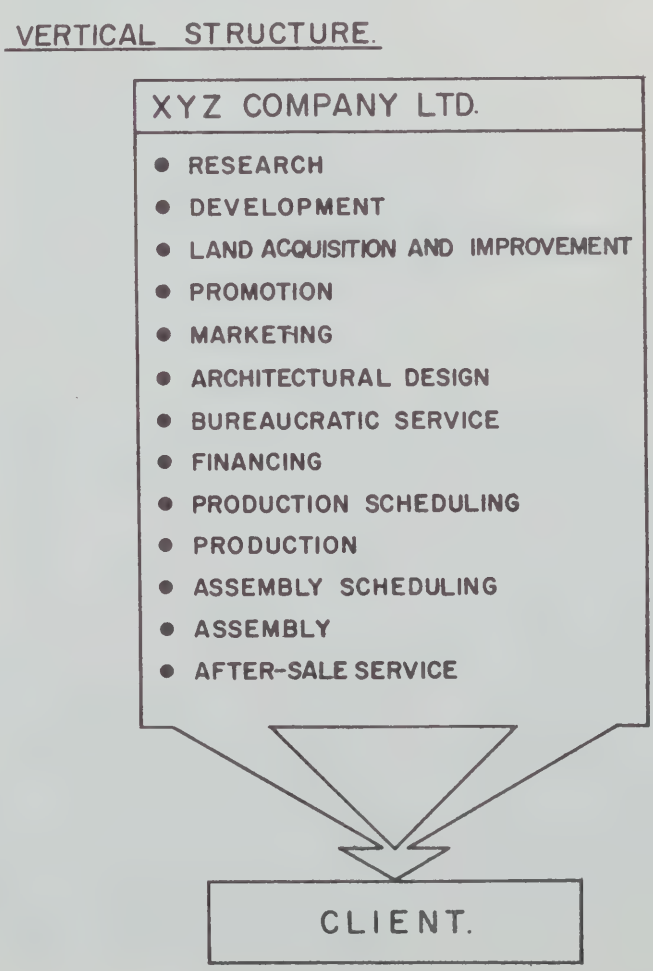
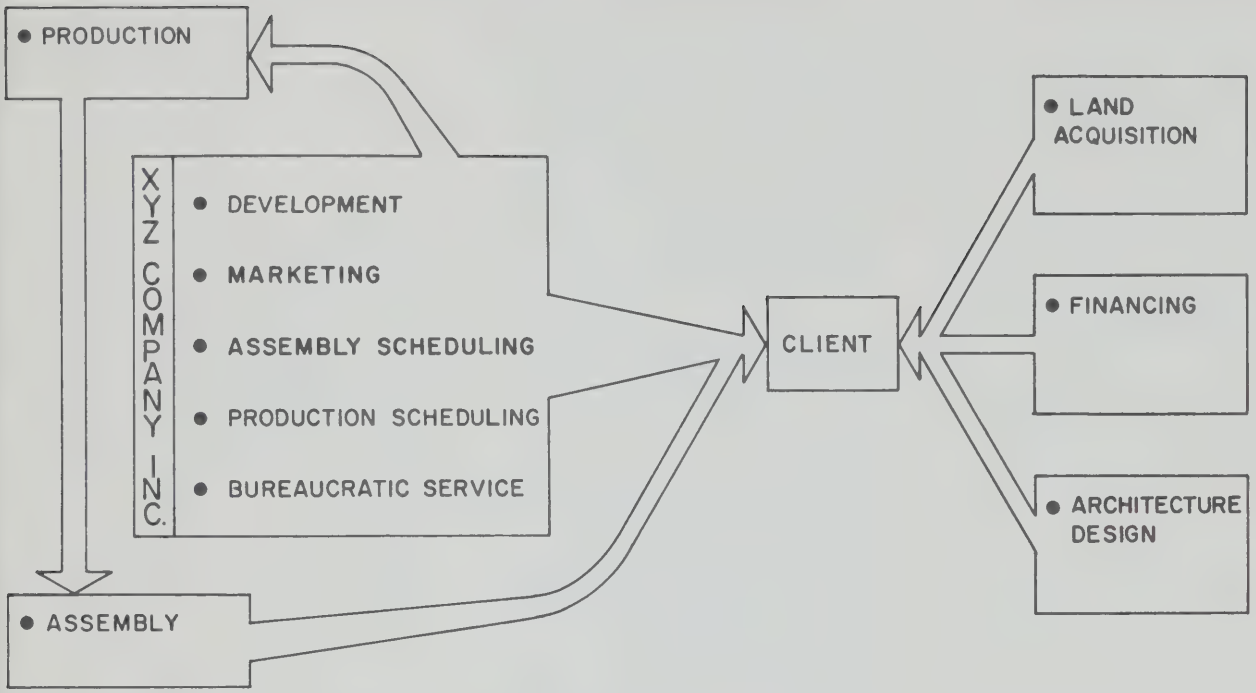


Fig. 6

HORIZONTAL STRUCTURE



(Fig. 6) The horizontal structure exists in many non-profit-making organizations and in very few profit-making organizations. As far as I know there are four profit-making organizations in Europe and one in the United States which follow this approach.

What does a horizontally structured company do? It "does" nothing, which is a very good starting point. It does not produce, it does not assemble. However, it develops a certain method of industrialized building.

The examples I know all concern modular building systems. A system is developed and components designed. Then manufacturers are selected with whom contracts are signed--open-end contracts, or closed contracts for one, two, three years, or for certain quantities.

The organization finally somehow secures a client. This may be the Government or a private client through the marketing service. In this case, they normally have to utilize their bureaucratic service to help the client. Finally they select a local contractor on the basis of cost and performance, and they pass the components which have been produced by somebody else to this builder to assemble. So production and assembly is totally outside their direct control.

Now, maybe before going farther, let us briefly analyze what is the advantage of one form over the other.

Clearly in the case of a vertically structured company you have everything under one roof. So, if somebody is late on delivery, you can kick him in his behind because he is one of your employees. If you have troubles during assembly, you can move staff from one place to another and complete the job on time.

What is the disadvantage, however, of a vertically structured company? First of all, enormous investment. You need a plant to produce your components; you need staff to run this plant; and you need equipment and personnel to assemble the components.

It means considerable lack of flexibility. If by any chance the cost of steel goes up and you happened to have designed your approach around a steel structure, you have had it. You cannot switch to concrete or to wood because you have a huge plant producing steel beams or steel columns and you cannot simply forget that.

It is also extremely unlikely that the sophisticated equipment that you have bought will be used to its full capacity for your own needs.

Some companies which are working at this approach, which include some of the biggest companies in wall-bearing systems, find that their whole production plan and process has become a stone around their necks. They cannot afford to improve their product because they have all this equipment, all this investment.

On the other hand, the characteristics of the horizontally structured company are exactly the opposite. The biggest problem in a horizontally structured company is success. As soon as it gets over a certain volume, manufacturers will no longer follow-up. They will see it extremely dangerous to keep producing for one company only, because of the danger of being practically controlled by that company or that organization. So, they will try to diversify. They will try to keep other clients.

For example, you set up a perfect organization which is capable of producing two million square feet of building a year. But when you reach the two million and a-half mark, you will see that you have to go to a second manufacturer and a third manufacturer for some of the sub-systems. That tends to create quite considerable transition problems. Likewise, you may find that even if you have worked out the most beautiful contracts and all clauses for penalties and what you have with your assembly subcontractors if and when a crisis really comes and the guy doesn't have the people to put on the job, you have had it. You cannot do more than penalize him.

However, the big advantage of a horizontally structured company is that they can switch from year to year to different materials, different solutions, and they have extremely low investments.

To illustrate, here are some numbers. Given a vertically structured company which owns its own production and assembly facilities, the ratio of capital investment to yearly production, be it in dollars, francs, guilders, or whatever, is in the order of 0.35.

Given a horizontally structured company, the same ratio is in the order of 0.025. That is, if capital investment is $100.000,000 yearly, production is in the order of $285,000,000 and $4,000,000,000 respectively.

Now, this is exaggerated obviously, because the horizontally organized structure makes use of the investment of other companies. However, it remains a fact that it is extremely easy to get underway with an horizontal structure, while it is extremely difficult to get underway with a vertical company.

In fact, going a bit farther, there are only two examples in Europe of horizontally structured companies going bankrupt, while I don't even dare to say how many examples there are of vertically organized structures going bankrupt.

Another ratio that may be interesting--and again don't forget it is exaggerated because a lot of the work has been done outside of the organization, but still it is relevant--is the square meter production per year related to the amount of staff you have.

The vertically organized structure has a production in the area of 170 square meters per person employed, including the president, the workers, and the girl who cleans the floor.

The figure for a horizontally organized structure is 1,850 square meters, including again the same kind of people. Of course, there are people who produce somewhere else. But the fact remains, if you want to get underway, it is much, much easier if you take the horizontal structure approach, even if later you have to develop or buy up or subsidize or take an interest in some production facilities, which seems to be the typical pattern.

Now, having analyzed these two forms, these two extremes, I have to say that both forms are bad, because neither is really satisfying the definition of industrialized buildings.

Why don't they satisfy this definition? Because neither of them is capable of controlling its own market. So, both of them are still passive organizations as opposed to being active organizations.

What is a passive organization? In the extreme form, the staff sits in its own office and waits for a client to come along--be it the State or a private client--present a drawing, saying: "Can you tender on this; for how much money will you do this building for me?

An active organization is one with just the reverse attitude. It has the design and goes out and sells the product. I think this is the basic difference between conventional building and industrialized building.

You can use all kinds of sophisticated technology, but if you remain a passive organization, you will never become an industrialized building organization, at least according to the definition I have given before; you will always be in trouble because you will never know how your production is going to proceed, or to really plan your production schedule.

Is it possible to become an organization which is active? There are some attempts. One of the examples one can mention from Europe are the Balency individual houses. There the company is really "going out" and selling to the client a product which the client can see.

Under the category of active organizations is definitely the mobile homes industry. The organization goes out and sells a product to somebody. They don't wait for somebody to come and ask for it. However, they are still a bit incomplete.

Now, let us see a possible diagram of what an active organization could look like.

(Fig. 7) It is a mixed kind of organization. You have a certain number of functions under one roof and a certain number of functions which are outside your direct control.

What syould you have under your own roof? Technical development is a necessity. Land acquisition? That is the dream, but when you have it, then you really control the market. Then you can schedule your production, you can schedule your assembly; you control your own life.

Building design: Promotion? If you don't handle promotion, you can never expect to get land. So, promotion becomes an extremely interesting case.

Bureaucratic service is of lesser importance. Marketing, Financing. Financing is an exxential part in most countries, be it for schools, hospitals, or housing. It occurs in different ways, but if you can finance through a bank or through somebody else, you don't have any problem whatsoever, no matter how lousy your product may be. (Laughter.) The point is, you can build. We have people coming out to Spain and saying, "Well, if you could finance 80 percent, we have a beautiful hotel to be built here or there." The trouble is, if we're to have 80 percent available, we would only have to put a tiny announcement in the paper and we would have a queue of people about a mile long coming about it.

In addition, there are the sale-services, the production and assembly; and finally you have research.

Research as the situation is today is practically unknow in any kind of organization in industrialized building. It is rightly so because companies or organizations which are involved in industrialized building are still extremely small. The biggest one is on the order of 4,000 people. To really afford basic research requires much more business volume and much more financing capability.

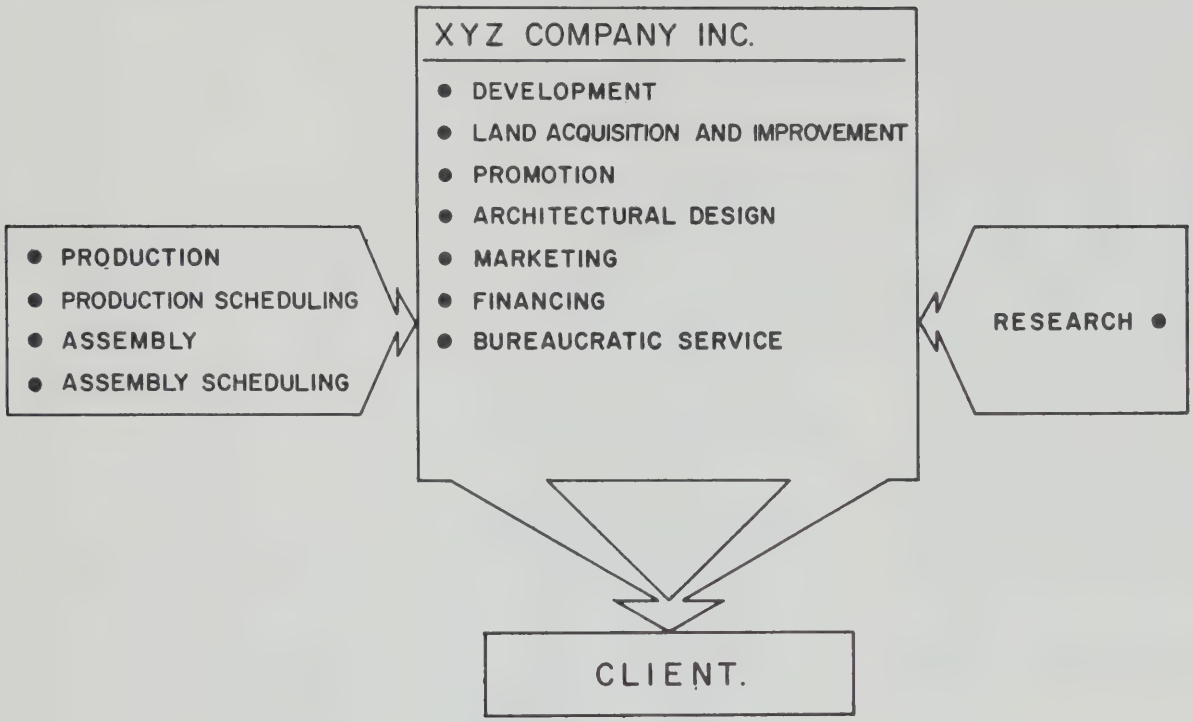
From another point of view it may be very desirable that research never be under the control of an organization whose interest is profit. Rather, it should remain independent from the organization so as to retain a certain amount of objectivity.

In this kind of sketch of model as I have shown feasible, or has it been implemented yet? At the moment, there are a couple of examples underway. There may be a hundred others I don't know of. What my partners and I consider essential for industrialization is the possibility of controlling the market; and maybe in some countries this kind of approach does not need to be profit-oriented. You can have this kind of approach "from the people, by the people," which is the big slogan going around Europe today--the people taking control of the design of their own environment.

This approach is possible as long as there are a couple of qualified technicians and administrators involved in it.

Fig. 7

MODEL OF MIXED STRUCTURE



BUILDING STANDARDS FOR SYSTEMS BUILDING

RODERICK G. ROBBIE
CANADA

I shall talk about the question of Building Standards for Systems Building today from three viewpoints. These viewpoints will be presented in what I believe is a descending order of importance.

All are intimately intertwined with each other and mutually interdependent. For this reason I believe wisdom dictates simultaneous action in all areas, an attitude I hope will prevail in the North American building community.

1. INTERNATIONAL POLITICS

The first viewpoint is concerned with the international political impact of the building industry and the dominant role of Building Standards and Codes as a primary device of international negotiation.

The political impact of Building Standards and Codes will prove, I believe, to be their primary international function in the next hundred years.

2. CULTURAL IMPACT

The second viewpoint is concerned with the cultural impact of Building Standards and Codes A viewpoint, which I believe has been more or less totally neglected due to pressing concern for the fire and structural safety aspects of building to this date.

The cultural aspect of Building Standards and Codes will doubtless be used as a device for manipultaing the international flow of building products to achieve international political objectives, as well as national cultural aspirations.

3. THE SYSTEMS APPROACH

The third viewpoint is concerned with the systems approach to Building Standards and Codes or the ways and means aspect.

The systems approach in this context will have two groups of principal elements.

Group 1 - To raise the overall performance of building industries to their highest levels.

To make national building industries extremely sensitive to national and regional cultural, social and economic aspirations.

To provide an organic, rather than the traditional, crystalline form of structure to the building industry and, consequently, give it the capability of smooth and rapid change. A capability which it presently totally lacks.

Group 2 - To fashion a control mechanism over national building industries, to change them from the traditional primary tool for internal national economic regulation to an external diplomatic, economic and political tool for international political and economic activism.

As already noted, the three principal factors of International Politics, Cultural Impace and the Systems Approach acting upon Building Standards and Codes will be deeply interactive.

Due to this interactivity a nation's performance in any given influence factor area will be conditioned by its efficiency, level of sophistication, and flexibility in the other influence factor areas.

For example, a country intending to use Building Standards and Codes as a factor in its international diplomatic activities would be well served is its internal standards and building codes provisions were organically systematic, and possessed a well-considered cultural factor. It would then be theoretically possible to use the country's building consumption and production capacities as a defined diplomatic tool in international negotiations while protecting the nation's cultural wishes in urban expressions.

To examine some aspects of these three principal viewpoints of Building Standards and Codes, may I return to each in turn. I shall deal with them in a North American context, but would presume that these views would have some application to all countries.

I. INTERNATIONAL POLITICS

Building Standards, methods of evaluation, testing, certification, Building Codes and other regulatory instruments are a closely related body of controls, through which public and private organs of power direct the activation of the Building Industry by controlling the on-site placement and erection of buildings.

This group of instruments is a complex as society itself. It is in fact the mechanism through which any society causes to have executed its finite attitude towards human and material values at any given time in its history.

To aspire towards a simplistic structure of building control instruments it to work towards a simplistic social order and a simplistic role for the individual in society. It is to quantify the City in readily comprehendable terms for a future where the City and Human Life will be intimately bound together.

I hold that it is not possible to quantify the City in comprehendable terms at this time, and that if our society moves in the desirable direction of individualism, the City as the primary expression of human life will become markedly less quantifiable.

As a consequence, I would expect the concept of continent-wide or even nationwide building standards and codes devoid of variations to be unattainable, in the purest form.

Examination of the body of building standardization and rebulatory devices indicates a tendency for standards to have the widest geographic acceptance and commonality. In some instances continent-wide, for codes and regulations to have a more limited territory of acceptance, with the general limitation being Province or Statewide, while official evaluation of building products and methods usually varies from municipality for a majority of building elements and activities. It can even vary between individual building inspectors in a given municipality.

Testing and certification tend to have a Province or Statewide territory.

It is interesting to note that as consideration of an act of building moves from the abstract as expressed in a standard to the finite building as expressed in an inspectorate evaluation decision, that the breadth of territorial influence of the specific control mechanism narrows.

The highly specific local factor in building regulation is an important reason why the traditional indigenuous building industry has a diffuse character.

The local factor characteristic of the industry makes it well suited as a conduit for political patronage from governments to individuals, vested employer and employee interests or communities. While the diffuse nature of the Building Industry and its consequent weak voice at the Provincial, State and Federal levels of government makes it through its disproportionate size to voice an excellent device for general economic regulation. In the U.S. the Building Industry is about twice as big as the automobile industry, but it does not have twice the influence of that industry. I would dobt that it has 5% of the influence of the automobile industry on American life and politics.

My speculation on the change of the political status and role of the building industry is based on the assumption that the nature of international warfare has now recognizably changed, from the military form to the economic form. A change which was largely initiated by General Charles DeGaulle's attacks on the U.S. gold reserves in the mid 1960's, through the rise of West German and Japanese mercantilism to President Nixon's U.S. economic blitzkrieg of 15 August 1971. The overlapping period between the military and economic forms of warfare can be expected to be extended and chaotic. It is hard to break a 250,000 year habit in a few decades, even when threatened by total annihilation, we are not that sane, yet.

With a passing of military war, an outlet for

very large-scale spending which can also be a tool of international politics will be sought.

Preferably one which involves a large tangible presence symbolic of the owning or generating nation's power, skill and prestige. International building is well able to fill these requirements. Like the diplomatic software which has always accompanied military expenditures whether domestic or as military aid, international building has a potent abstract influence, as the carrier of cultural values, images, and standards between countries. Especially, when building is seen to include the entire physical apparatus which constitutes the modern city.

At this time the nations of the world spend about $203 billion annually on military appropirations of all kinds. By 1980, this is expected to reach $300 to $350 billion per annum according to a recent United Nations study, making the arms expenditure from 1961-1980 $2,650,000,000,000 or enough for a $2,500 house or car for every family on Earth. A substantial minor percentage of this amount is spent on the overkill capability which was considered a necessary ingredient of world politics based on the threat of military confrontation.

With a switch to economic warfare, in recognition of the futility of large scale military war in Viet Nam, the prudent nations are going to be seeking the fatest possible turn around from a military posture as a symbol of power to a hardware orientated economic posture.

It is well within the bounds of possibility that the comind decade, will see a giant cut in world appropriations for military purposes. This will not indicate the arrival of civilization in the late 1970's but rather a change in the nature of international power politics.

It is quite probable that at least $100 billion per annum will be diverted from military budgets to so called peaceful purposes by the end of the decade.

For reasons of effective international politicking, it is my view that the largest part of this money will be used to produce housing, health and education facilities. Let me say immediately that I would doubt that this will necessarily be the best way to spend the money so far as the average individual is concerned, any more than guns, planes and bombs have been during the ages of militarism. I think it will get spent on building because building will be in enormous demand and will tend to benefit the selling nation as well as the recipient nation while at the same time providing an effective propaganda vehicle.

The potential power of this international inducement to playing power politics with building materials can be appreciated if the impact of $100 billion per year on world housing needs is examined.

Assuming that the primary demand could be satisfied with a basic dwelling which could be mass produced for $2,500 per dwelling. $100 billion per annum would provide 40,000,000 dwellings per year. Assuming zero growth of world population as of today, it would take 20 years at this rate to meet the world basic need for sanitary housing accommodation. Accepting the projections of world population growth rate this rate of housing production could not meet the needs for about a century.

With housing needs of this magnitude in prospect and the probability that the character of international politics would change from coercive to persuasive with the switch from military power to economic power, the nature and significance of the restrictive powers of Building Standards, evaluation, certification, and codes can be expected to change from being only of parochial significance to national and international significance. When building starts to gain a national and international political power significance, it will rapidly gain the kind of importance to national governments which the industry has never had, an omission which is a perrenial complaint of the building community, but, which in retrospect, from the viewpoint 1980's or 1990's, may make today's neglected industry look sane, peaceful and thoroughly commendable.

For building as an economic war industry will attract all the bureaucracy, banality, and waste which has characterized National Defense in the past. In the giant international economic power game its human and cultural purpose could be lost. It is to try and save a substantial part of the industry's resources to fulfill its human purpose that I list CULTURAL IMPACT as the second important consideration to be observed when framing the standards and codes to control the building industry.

2. CULTURAL IMPACT

With the passing of military conflict in favor of economic conflict as the standard international method of resolving serious opinion differences, rapid changes in national life styles can be expected.

Militarism in all its forms as practiced between East and West, mandates the existence of social authoritarianism as exercised by coercion of the individual, to support it as a credible international means of solving conflicts, and problems.

The spreading realization that militarism does not solve international problems or resolve serious conflicts of opinion has moved the interest of those concerned with international power politics to economic warfare. At this time, attempts are being made to wage economic warfare by the coercive and authoritarian tactics of military warfare. Which tactics can be expected to fail during the years ahead, and give way to the recognition that economic confrontation can rest only on persuasion and the respect of self-determination.

Should such a passage of events occur they could be expected to have an alarming effect on the religously held political and social doctrines of the East and West. In these circumstances it is highly questionable how either side can continue to convince their populaces of the extreme evils of their opponents' views, as expressed through the extreme application of competing economic theories. A middle ground favoring life style as it effects the individual rather than life style as it effects the interests of the state, must emerge with the removal of military and parap-military coercion, both domestically and internationally.

In a somewhat similar sense the competition between the strongly anti-material social theory which has arisen in North American and particularly in the United States, as a balancing extreme to coercive corporate materialism must find popular resolution on a middle ground. To the poor Canadian, or American who has never enjoyed the fruits of North American industrial potential a return to the fields and woods sounds about as phoney as the corporate advertisement claims of egalitarian interest.

The desire of less fortunate North Americans to taste the fruits of industrialization and make their own decision to reject those fruits, rather than have that decision made for them by the children of middle and upper-middle class suffering from a passing boud of environmental bad conscience, will become a major factor in the shaping of urban North America.

What is true for low income North Americans can be multiplied in intensity by perhaps a million to measure the feelings of the underpriviledged of the Earth.

The problem is how to satisfy these pent-up human aspirations, much of which will be expressed through building and other urban apparatus without wreching the Earth. To stop this surge towards consumer materialism is impossible once military authorianism wanes. The only hope for the most strident conservationists is to make common cause with the industrial - military complex and make the latter's reason for existence land preservation rather than land acquisition.

Assuming that the latter does not occur, the reduction of military spending and the deflation of coercive political systems can be expected to result in an almost traumatic growth in consumer product production, international travel and communication which will coalesce into the first universal world culture. Which might be called the universal-transport-communications-consumer culture.

The pilot project for this culture has proved itslef most attractive to the average citizen in the North American continent experiment of the past 200 years. As the gut culture of the man-in-the-street, in North America it has overwhelmed every other culture which has been brought to this continent and those which predated the imports. Since World War II, it has spontaneously seeded itself in all other continents and nations of the world even where these nations disliked the United States of America.

The application of industrialized building techniques through the systems approach by the Building Industry will tend to address itself directly to the individual members of the world public as a consumer commodity, rather than by its present traditions of the channels of Government control. Herein lies the hope of satisfaction of the aspirations of billions of the world's people and within the hope lies a frightening incubus.

The incubus comprises the power politics of building I have already reviewed and the homogenization of the Earth's built environment in the next 50 years.

Power politics is the largest on-going manifestation of the residual madness in the human species as it struggles to come to terms with the realities of the mind.

The extent of this madness is well documented in the history of activities surrounding the human experiment with militarism. In that instance our species toyed directly and indirectly with its own elimination by direct simple personal destruction.

With the end of the military experiment and the beginning of the economic experiment, this on-going human madness will be transferred to a physical material context. A context where all the myopic passion of the military-industrial complex will be transferred to consumer production. Building being the area in which the largest sums can be spent, and the one in which a virtually endless mass market of recycled forced absolescence can be generated, will become the prime target for the econo-industrial complex, which will harness surplus agricultural potential, and tend to be organic rather than mineral based and will be ecologically acceptable to all living states except those of the human mind.

There will be no prima facie reason for denying the spread of the urban expression of the universal transport communications consumer culture, except the preservation of the opportunity for the development of the human mind in its own right.

SPRAWLUS CONSUMORUM, the urban expression of the universal transport communications consumer culture will provide verything the human body could ever desire and everything the mind could want with the exception of the totally irrational, the unexpected, the naturally vulgar, and the breath-takingly beautiful. In short SPRAWLUS CONSUMORUM will be the great leveller.

The fact that this can happen may be observed by examining North America, the worlds's first sustained test of SPRAWLUS CONSUMORUM. There exists in North America an urban mode of expression which is so common that without the exception of an examination of the heating and cooling systems used, it is impossible for all practical purposes to tell whether a given piece of new urban sprawl is in the far north, south, east, west, the middle of the continent, or whether it is in Canada or the United States.

Today in North America everywhere looks like everywhere else. Yet despite the efforts of corporations and governments we still don't quite all think like each other.

What has already happened in North America is well advanced in Europe and seeded throughout the world.

As one with an interest in the development and exploration of the human mind and its unused creative potential, I find the prospect of an uni-environmental world deplorable.

For I am also a strong believer in the notion that whereas the built-environment may not be able to stimulate human creativity, it can certainly stultify it.

The present trends in a Building Standards and Codes conceptualization and the techniques and methods of evaluating building quality and performance and the enforcement of building regulations is technicall, materially and economically oriented to the total exclusion of any cultural consideration. In order to facilitate the rehabilitation of the building industry to meet North American building needs, the regulatory mechanisms acting on the industry will be simplified from their present chaos. This simplification will radically improve the performance of the building industry, making it a more attractive financial investment. An inflow of major investment will improve the impoverished research and development capabilities of the industry causing dramatic improvements in its stability and profit performance. At some point, this chain process will attract landslide investment in the industry. It will become fat, self-serving and because of its intimate relationship with every aspect of human life, damn dangerous to our long-term best interests as humans. If we think militarism was bad, we should speculate for a moment what a super-efficient, profit oriented, power politicking, government backed building industry could do to us without us really knowing. Already it is rumored that building interests are getting into the local media in Toronto as a means of getting to influence the public mind on environmental questions.

The introduction of cultural content into the regulation of building is, I believe, an urgent matter. I think the time has come for us to take our primary attention for a while off building technology, of which I believe we have a ten year supply and look hard at what we are doing with it. We should examine the rights of the user and recognize the users' slavery to a built environment fixed to serve short-term absentee economic ends.

We are just at the threshold of a world building boom which could in no small measure influence the future nature of the human species. I think we should consider very carefully whether we want this enormous human effort directed solely to political, economic and general social ends or whether it should contribute to the expansion of the abstract capacities of the human psyche. The choice is ours to make, the means are relatively simple, the task is boring, drawn-out and important. It is dominated by physical scientists and the representatives of industry.

A balance is needed from building professionals, social scientists, citizens at large and building labor.

The funding of building standards research and writing and code preparation seen from a cultural viewpoint is precarious. At this time in Canada, the Division of Building Research of the National Research Council of Canada exists on an annual budget of $33 million. To do its scientific and educational job in a manner befitting the best long-term social and cultural interests of the Canadian people the Division of Building Research should today have a budge of $30 million escalated annually to serve the emerging needs of Canadians.

The Canadian Standards Association lives by contributions from Industry and selling its services to industry. With a benevolent building industry, as we have at present in North America, this arrangement seems satisfactory. I do not believe that standards funding should be so heavily dependent on industrial contribution if the building industry starts to take over from the world's plane, gun and bomb makers. I believe a three-way arrangement of financing from Industry, Government and the public at large is needed.

A third important regulatory institution in Canada is Underwriters' Laboratories of Canada, a subsidiary of Underwriters' Laboratories of the United States. This important testing organization has been set up by the insurance industry as a service to its underwriters. Its purpose is to protect the investment of insurance companies in property insurance. Again in the leisurely atmosphere of building in the past this arrangement has worked well.

I believe in the possible climate of the future, that the control of a facility whose findings are entrenched in numerous building codes, specifications and regulations should not be a creature of interests who will undoubtedly be providing major financing to the growth of the building industry.

Underwriters' Laboratories of Canada and the United States should be purchased by the governments of these respective countries and turned over to non-profit corporations with balanced representation on their Boards of the Public, Government and the Building Industry. The insurance industry should no longer be saddled with the liability of having the means, even if not used, or writing building codes and regulations to meet their view of an acceptable built environment.

In the application of the industrial process to building, it is my view that world-wide environmental and cultural homogenization will result from the wholesale shipment of complete buildings between countries and most particularly housing.

It is my view that the astute countries will be those who insert cultural clauses into their building codes which will prevent the importation of wholly premanufacture of housing units or housing designs which will import foreign cultural values without passing through a user approval process. It is my view that the shipment of premanufactured housing between countries should be restricted to sub-systems in an open matrix. That companies manufacturing and shipping sub-systems be prevented by law in having any interest whatever in the assembly of sub-systems into whole buildings in a country foreign to their origin.

That all building manufacturing, assembly and design be 66-2/3% owned and controlled in the country in which a building is finally erected. Under no circumstances should companies of the dominance and magnitude of the big three U.S. automobile makers be tolerated in any nation's building industry, on the grounds of cultural caution. Nor should the industry fall into the effective control of so few hands.

The cultural content of codes should be designed to prevent the user from delegating the whole responsibility for making environmental and building decisions to others. The codes should seek to enhance to a major degree the urban, and physical environmental consciousness of building users.

A serious weakness in the design and construction of cities from the early 19th Century until the present has been the effective muzzling of the citizens' environmental and building wishes. Constantly, technical complexity, is pleaded by urban planners, traffic engineers, municipal and public works engineers, architects, developers, building officials and their politician mouthpieces, as a reason for imposing only quantifiable decisions on urban citizens.

The human and spiritual aspects of city building are brushed aside as the sole concern of leftwing factions, egg-heads and finks of all kinds, some even with long hair.

The popular official and building industry technical view of building is definitely non-participatory so far as the public is concerned. Yet every building professional of skill and integrity knows this attitude makes a lie and a hoax of the declared purposes of his profession and most especially the public claims of a majority of the housing development community. Any person with a high school education can grasp not only the generalities of city building but also it subtlties with modest effort. A grasp of sufficient level within the capacities of a majority of citizens to make intelligent choices between alternate strategies of city building as a whole and in its detailed specifics. Certainly a sufficient grasp to ensure that North America's cities of the future represent the highest aspirations of all its people--in a pinnacle of collective creative expression and not an endless refuse dump left by a generation of the self-serving, money grubbing, wholly economically motivated and power hungry members of the building community, who at this time are the ones most likely to conceive and build our urban environments should building become a tool of world politics or even continue substantially on its present singular profit oriented pattern.

Potent cultural clauses in our Building Standards, Codes, Regulatory instruments, modes of building certification and evaluation can act as a first line of control to ensure that the North American public has the time to fully develop its dormant universal awareness and the skills needed to ensure that it will inherit its built environmental birth right. Today that right hangs by a very tenuous thread. Following present trends and future possibilities, it can only get words, unless resolutely checked, and re-emphasized.

If we who recognize this need, who recognize the threats to its fulfillment, neglect to take the necessary action in the coming decades, we shall have been charlatans, of historical uniqueness.

We shall have knowingly contributed to environmental genocide.

May I know turn to my third viewpoint concerned essentially with ways and means and which I have called the Systems Approach.

3. THE SYSTEMS APPROACH

As I have noted earlier, this viewpoint has two groups of considerations.

Group 1: Those events and actions through the medium of standards, codes and other regulatory mechanisms which will assist and direct the building industry to do a better job of providing the housing of the entire human process, and

Group 2: The things which will likely get done to building standards, codes and other regulatory instruments to change the building industry from a tool for internal national economic manipulation to one with international manipulative potential.

In practical fact the nation which structures its building industry with a primary concern for its international political effectiveness will tend to environmentally disenfranchise its own citizens, providing for them a cage which is an economic political weapon rather than a built expression of their culture. There is no doubt that some countries will fall into this self-laid trap. They will be those with a mercantilist attitude to world trade and international relations.

Regrettably, with a trend to economic war, no country and especially those with high per capita buying power will be able to ignore the international political power potential of their building industries.

The rational approach to an effective international political building diplomacy will grow from a well founded built-environmental home base. Only by this means can a nation know what it wants to be and preserve the integrity of the urban expression of that culture. Only by being acutely sensitive to the true urban wishes of its people can it develop an international building economic diplomacy which is supportive of rather than destructive of the wishes of others.

Sensitivity to national cultural characteristics and aspirations reveals anaylsis of the users of buildings and their requirements to be the single primary weakness of all building practice, including all aspects of building regulation in all countries at this time.

The cost and the statics aspects of building are known in vast detail. The mysteries and subtlties of all forms of architectural and structural engineering expression are endlessly and lavishly documented for the perennial and mutual enjoyment of building specialists and the lay brothers in the architectural and artistic press.

The intense study and understanding of the users' needs remains an unanswered question.

3.1 USER STUDIES AND REQUIREMENTS

The first requirement to make building standards, codes, regulations and modes of certification and evaluation culturally responsive, lies in the need for a vast increase in user research.

To facilitate this research, it is proposed that building types be broken down into a number of principal generic groupings which might be internationally recognized.

Such a generic classification of building types would facilitate international research co-operation and highlight the desired environmental differences between nations, regions and comunities.

User requirement studies should cover the psychological, social, communications, sensory, quality, cost, flexibility and life duration requirements of all generic building types, city and regional development.

Officials responsible for standards research and preparation, code preparation, building and building product evaluation, and most particularly all forms of code and regulation enforcement should have a training and skill which places equal emphasis on the user aspects of building as on the technical and safety aspects. This suggestion implies a major up-grading and broadening of the skills of those who normally provide these services in North America.

Related to this up-grading of building regulatory staff, it is proposed that all architects, civil and structural engineers, mechanical and electrical engineers, traffic, municipal and utility engineers, all forms of town planners and all construction managers be required to pass qualifying examinations in the social and user aspects of building, as a condition of the right to practice.

Further that all departments of government, and all private organizations concerned with the construction of buildings or the manufacture of products or supply of materials be controlled

only by persons so socially and user qualified. That the boards of all such companies be 66-2/3% controlled by persons so qualified and that the importation of pre-manufactured building equipment materials and components be permitted only from companies and enterprises run by socially and user qualified persons.

Such an inclusion of a mandatory social and user qualification in the effective ownership and power structure of the building industry would provide an effective route through the Courts and Civil and Criminal Codes (in the case of Canada) to make the building development and construction industry directly and effectively accountable to the public.

3.2 STANDARDS, CODES, CERTIFICATION

Building standards, codes and modes of certification should be framed to encourage innovation and creativity among the members of the building community. For this reason the performance-judgement approach to these regulatory instruments is recommended.

Such an approach suggesting a major improvement in all areas of building research and building related education. Thereby, providing progress towards the practical realization of a performance approach to building, and a body of skill at all levels of the industry capable of using the performance approach to building.

In conclusion, we in the building industry have all been part of a service industry since the beginning of time.

We are part of an industry which in the coming decades will mutate to a tool in the armory of international power politics. Such an event could swamp the industry's primary cultural purpose.

Our job is to see that our international financial and power greed does not kill our collective cultural development.

Regulation of building, in all its aspects, is our only practical and potentially effective protection against pollution of the Earth with building.

THE BALENCY SYSTEM

RICCARDO MEREGAGLIA
ITALY

INTRODUCTION: I was educated as a civil engineer but have always worked as a constructor as my father and grandfather did. I formed my conventional building company 27 years ago.

To be a constructor in Europe generally means that one must be builder, manufacturer, and often developer. Most of our work is done by our own men and only a few jobs are subcontracted-- we generally have complete responsibility for the product.

In 1962, while continuing with my conventional company, I founded a new company which has a truly industrial structure and uses the Balency Systems. It began operating in 1964 and so far it has built more than 5,000 dwellings. I don't want to brag but two years ago Fortune magazine stated that I'm operating what is probably the world's most efficient systems factory.

A year ago I merged the two companies to be able to face the market better.

I have come to know the building field in many European countries, and I'm involved in the U.S. with an American company which was among the 22 Operation Breakthrough winners.

MY THEORY: My task here is to tell you the whys and hows of my experience. I want to give you the core of my experience by explaining my theory not only on Systems building but on the whole building process. I think if we look at the process we'll better understand each part.

For example we'll better understand the great differences between prefab, systems building, and industrialized building-- their causes and effects.

Today there is a terrible misunderstanding on what the actual building process is and therefore a great confusion in semantics. I won't define the different terms here but if these are not cleared up soon it could be dangerous. Let's take Ford's very first car as an example-- it was considered in its time to be just a carriage with a motor, instead, it was the first step toward a revolution, not only in transportation but in the way of living. We all can see the enormous consequences of this.

THE BUILDING PROCESS: I've put what I call my theory on a chart and, as you can see, it's only an oversimplified outline and obviously not self-explanatory. I'll go through it quickly now but obviously it will need a more thorough discussion. (See pages 64 and 65).

The building process means the whole building operation but here we are limited to housing, which is situated in a certain location at a certain time-- we can't generalize space or time. Location doesn't mean nation, but locality which can be smaller or larger than a nation.

The chart is divided vertically in four main parts: time periods, situation, solution, and results.

I'm using 6 different time periods to represent classic building situations; their length is undetermined and they refer differently to the various locations, e.g. what happens today in the U.S. happened 20 years ago in Europe.

The situation is what exists in the building field, particularly the market, skilled labor, design, and programming. Traditionally the situation is out of the producer's control.

The solution is the producer's answer to the situation. It includes his organization, technology, the components and materials he uses, his money investments and the men he uses, his approach to the market.

The results are what come from the producer's activity: construction time, costs, etc.

The first important point is that there is a strong double relation of cause and effect among situation, solution and results. That is, we have at a given time in a given location a certain situation which obliges the producer to implement a particular solution. This solution determines almost automatically certain results. If we are not satisfied with the results of today's high building costs, then it's useless to claim that the right solution is systems building. It can be, provided the situation determines its necessity or possibility.

Let's start from zero time-- what is the situation? The market is traditional, i.e. fragmented, intermittent, and episodic-- the demand is supposed to be low. Labor and particularly skilled labor is available and very cheap. The design is made by the client's architect and is different for every project. Some building theorists call this "unique product". Client controls programming.

The happens, for instance, in India today and it happened in Italy during the late 1940's. The producer adapts himself to this situation: his production must be craft; product and services are manual; and his activity is intermittent. Obviously easy to handle materials are used, such as wood, brick, blocks and almost no money investment is required. Theoretically only the producer's brain is needed-- three pounds is really the weight of an average Italian brain.

The producer's organization is of course conventional and, what is important here, is that a new team is set up for each operation. The producer's efforts are product oriented. The product is sold or priced before being produced. The results are of course long construction time but with normal costs.

Now, every item has its own evolutionary trend, but at a certain time for definite reasons it has its own revolution, small or big. In the chart all changes are underlined and revolutions are indicated in color.

The two most important items are demand and skilled labor. Both have in every industrial country an irreversible trend-- demand toward a tremendous need for low-income units, skilled labor toward an ever increasing shortage. Because of the double automatic reaction of cause and effect when the situation changes, the solution consequently changes with a logical change in the results.

In time period 1, when labor becomes rather expensive we mechanize services with an investment of money and brains and we get a normal construction time.

In time period 2, when demand becomes high there is some shortage and high cost of skilled labor, we use prefab components and we get some labor reduction.

Time period 3 is an evolution of 2 where everything increases. At a certain time, as is time period 4, demand for low-income becomes tremendous and simlutaneously there is a great shortage of skilled labor-- conventional production can't solve the situation and the producer is obliged to find the solution in systems building, i.e. the product is made by machine (the factory is created) and the prefab components are integrated with mechanical works and finishing. The producer needs three times more money and very clever people for implementing this. He uses in-house prefab production and more important, the same team handles every operation. The almost automatic results are short construction time, cost reduction or containment, labor reduction, and sufficient volume or production.

Time period 5 is the industrial one. We shift from systems building to industrialized building only if we have continuity-- continuity of production and therefore, continuity of sales.

For having this, the producer can't accept the conventional bidding approach; he must market his product and handle both design and programming. It follows that the product can no longer be unique but must be series produced models.

Actually all this can be implemented in a free economy if the producer revolutionizes his own market by becoming a producer/developer, or if there is a governmental market such as Phase 3 of Operation Breakthrough. Industrialized building needs single management which will handle, with its own technicians, every production phase starting from design up to the finished building. It also needs software and self-marketing.

The money investment is about the same as in systems building but the brains needed are at least double.

The final results are impressive-- what is completely new is consumer satisfaction and limited land speculation.

This is the same process which in the last 100 years has created industry and the consumer society for such things as cars, shoes, food, etc. Only today is this happening in the building field and only in some locations-- its expansion will be stupendous.

I hope we will be able to analyze it and control its consequences better than we did with Ford's revolution.

TIME PERIODS	SITUATION				
	MARKET	SKILLED LABOR	DESIGN	PROGRAMMING	EXAMPLE
1	2	3	4	5	6
0	a - traditional: fragmented, intermittent, episodic b - demand : low	a - available b - ~~very cheap~~ inexpensive	a - client's arch. b - different for every project (unique product)	client	India today Italy 1940's
1	a - as above b - demand: normal	a - available b - rather expensive	a - as above b - " "	"	U.S. 1950's
2	a - as above b - demand: high for low-income	a - some shortage b - expensive	a - as above b - " "	"	U.S. 1960's
3	a - as above b - demand for low-income encreases	a - shortage increases b - very expensive	a - as above b - " "	"	U.S. 1970's
4	a - as above b - demand: tremendous for low-income	a - great shortage b - very expensive	a - as above b - as above, but bigger projects	"	Europe 1950's 1960's 1970's
5	a - new building market continues b - demand: as above	a - great shortage b - very expensive	a - producers eqp. + engineering staff b - building models	producer	Europe now? U.S. ? U.S. Phase III Oper. Breakth

CHANGES

REVOLUTIONARY PHASES, ALL OTHERS BEING EVOLUTIONARY

PROCESS FOR HOUSING

SOLUTION						RESULTS
Type of PRODUCTION 7	Basic COMPONENTS and materials 8	INVESTMENT MONEY 9	INVESTMENT BRAINS 10	ORGANIZATION AND MANAGEMENT 11	APPROACH TO MARKET 12	13
-craft -product made by hand -service: by hand -intermittent	easy to work by hand (wood, bricks, blocks etc.)	$ 0	lbs 3	-conventional: fragmented activity and subcontracting -new team for each operation	a-conventional: product oriented b-unique product sold or priced before being produced	a-long construction time b-normal costs
-as above - " " -service: mechanized -as above	"	$ 1	lbs 9	"	"	a-normal construction time b-as above
-as above - " " -service: more mechanized -as above	as above + bigger prefab components produced by molds and handled by machines	$ 2	lbs 12	"	"	a-as above b-higher costs c-some labor reduction
-as above - " " -service: highly mechanized -as above	as above + more prefab components	$ 3	lbs 15	"	"	a-as above b-very high costs c-more labor reduction
-building system -product made by machine (factory) -service coordinated with production -intermittent	mostly prefab produced by universal mold machines. integration of mechanical work and finishing	$ 10	lbs 45	-conventional + hardware technology + in house prefab production -same team for every operation	a-as above b-series product sold or priced before being produced	a-short construction time b-cost reduction (for contained) c-high labor reduction + labor contentment d-volume of production according to demand e-spinoff for conventional building
-industrialized building -as above - " " -continuous flow of production	as above	$ 10	lbs 80	-single management + hardware + software + marketing -as above	a-market oriented b-series product sold from models	a-as above b-more cost reduction (for better contained) c-higher labor reduction + great labor contentment d-as above e-more spinoff f-consumer satisfaction: better quality, livability, environmental factors, and economy g-no, or limited land speculation

BOSTON ARCHITECTURAL CENTER
SYSTEMS BUILDING CONFERENCE
R.MEREGAGLIA'S PRESENTATION oct.1971

THE OPERATION BREAKTHROUGH EXPERIENCE

DAVID A. CRANE
U.S.A.

I have been asked to speak about Operation Breakthrough as our organization has experienced it at Jersey City, where we are serving as the Prototype Site Planner for the government.

HUD's choice of Jersey City as a site among a total of nine for the Operation Breakthrough program was made in December 1969, and our organization was appointed as the Prototype Site Planner in January, 1970.

I reckon that the selection of Jersey City and this rather bizarre site was based primarily upon the vast New York region market of 25 million people, to which there was a desire to make some kind of a demonstration of how systems building could be applied to high-density living. The project will accommodate a community of 490 dwelling units on a very tight, awkward site of 6.35 acres. It is within 20 minutes' ride of lower Manhattan by the Path Tube system.

The Prototype Site Developer is Volt Information Sciences, Inc. of New York, previously a software expert in the urban ghetto. There have been at one time or another four different Housing Systems Producers, whom I shall introduce somewhat later. At the moment there are only three; they are not the same three with which we started some while back.

I should mention that all of the ingredients for a total industrialized process at Jersey City were not operating precisely on the same timetable. For example, we were in operation for four months before it was known whose systems we would accommodate on our site, and we were in operation five months before the Developer, who was intended to coordinate the whole development operation, was available. .

This put certain pressures upon the site designers to carry some of the traditional burdens of the developer during those early phases. The extensive ups and downs of this project have led to considerable delays. According to the original timetable we should have been finished within a few months from now; instead we expect to be completed early in 1973. However, construction on the site has started even though certain aspects of design are still in process.

As we began our work early in 1970, three overriding concerns were in our minds. First of all the site had to provide an optimum context for Operation Breakthrough's high-density demonstration objectives, which we took to mean several different things:

- First of all, it had to accommodate between two and three different systems producers. Each of these systems producers had to be able to demonstrate that he could produce a variation of high- and low-rise for various family sizes.

-Secondly, there had to be a maximum variety of dwelling unit qualities and a balanced population, socially- and economically-speaking, albeit within a very tight site.

-And third, the demonstration had to emphasize the possibility of creating family living conditions under reasonably high densities. If there is one single factor which has contributed to social segregation on a metropolitan scale it is the tendency of social and economic characteristics of family types to coincide with building types. If we cannot begin to fit our higher-density forms of structures to the conditions that a family with children requires, then we shall continue to contribute to territorial segregation in metropolitan regions.

A second overriding concern was that although the program was mounted as a demonstration of hardware for housing in the United States, we wanted to be sure that this was going to be a permanently viable community. And we had to do this in context of a site which had the advantages of proximity to New York. Indeed, visibility of the New York skyline from the site is possible if you can get 20 feet off of a rather tawdry street level found in the middle of Jersey City. At the same time we wanted to make sure that the mix of units and of facilities-- schools, recreation, and so on,-- would make it possible for people to live there on a continuing basis. This, therefore, is not exactly the kind of prototype that one builds out in the back lot of a factory. It is a living. Twenty years from now people will no longer appreciate the fact that it was produced by Operation Breakthrough. Nevertheless, they will judge whether it is a good or bad urban environment.

Third, we wanted to demonstrate the role that environmental large-scale repetitive housing. We wanted to stress new approaches to mixtures of land use, and mixtures of space use within structures; handling of the parked car, that old nemesis of housing; new forms of energy, waste disposal, and so on.

The Jersey City Operation Breakthrough project will include demonstrations of pneumatic trash collection systems and of a total energy plant. We wanted to demonstrate also that within the context of the home environment a rather broad range of community service can be delivered; as the well-known community of Tapiola builder, Heikki von Hertzen, likes to say, "Our business is not making houses, it is making communities." The only way we can accomplish this is to look at technology on its broadest level as a process of delivering all of the ingredients of a total environment.

What is the relationship between environmental design, innovation of site technology, and systems building? I won't take too much time on this point because Mr. Testa and others have given us a very good exposition of the whole relationship between land, money and time, one one side, versus technology. We know that those first three factors have a far greater capacity to reduce housing costs than technology per se.

We also know that if technology produced in the factory is going to be timely and reduce costs, it is going to have to be packaged in a critical mass of community-building effort.

Our approach to the Jersey City planning was based in our earlier experience in the model community mandated by the Johnson Administration at Fort Lincoln in Washington. In that brave attempt at urban innovation there were certain interests that were preoccupied with use of new building systems, almost to the point of creating a "technological zoo." We had been asked to make a technological research study for Ft. Lincoln, which HUD later put out as a monograph: Developing New Communities, Application of Technological Innovations. We went to great lengths in that report to demonstrate that if we were going to create any new technological breakthroughs, the issue was not hardware but organization and management.

So from that kind of background, and concerned with the software aspect of technology, we were convinced that we had to find some of the other qualities that industrialization possibly offers-- quality improvement, user choice, broadening the concepts of circulation, energy, and so on-- if we were going to fully justify the contribution that technology can make in housing.

We approached the Jersey City demonstration project, now just as a showcase for fabrication concepts, even though that was the major preoccupation of the program, but really as a demonstration of how technology and organizational concepts might produce total environments.

It will be my thesis in the following slide presentation that these attitudes of comprehensiveness of approach and of concern for software are the principal tests by which our own efforts at Jersey City will have to be measured. To the extent that we have not completely fulfilled our own formulation, it will be my contention that the primary culprit in the act is not HUD, even though you will hear many complaints from the systems producers about HUD; it is not the producers; it is not even the architects. It is really all of our faults in the sense that we permit a persistent preoccupation with gimmicks, structured hardware, and architectural stereotypes. Until we can rid ourselves of some of these particular concerns and recognize that the technology for the human community is enormously more difficult and more software oriented than is the making of space age vehicles, then we shall have made very little progress indeed.

Now, if we can have the lights out, I would like to take you through what will be a rather visual experience. We shall not have time to go into too many explanations of the individual slides, but I will try to give you the epochs and the history of the Jersey City project.

(Slide) The site is the residual part of an urban

renewal project on which high-rise apartments for families exist already. You see the peculiar site configuration of a little less than six and a half acres on the right.

(Slide) There are many views of the Statue of Liberty, the North Jersey marshes, the Manhattan skyline, and so on; provided, of course, that you can somehow find a way to get the pedestrian viewpoint 20 feet off the street grade and orient all the dwelling units to appreciate these views.

(Slide) In our minds, aesthetic recognition of the regional context was an extremely important factor in inducing social groups of unlike character to live together in such a small space and in the middle of Jersey City.

(Slide) The site is surrounded by traffic, with more traffic on the smaller end of the site than elsewhere. This is an advantabe in some ways from the standpoint of marketing some of the commercial uses that you will see in the development plan.

(Slide) We measured the presence of existing recreation, schools, and other community facilities to serve the on-site population. We discovered that Jersey City had only two parks, both of which were 30 minutes or more walking from the site. Also there is a 40-classroom shortage of school facilities within a reasonable distance of the site. As the same time, Jersey City had no capital program with which to build any such facilities to serve housing put on the site.

Therefore, the site had to have a degree of self-containment in terms of having its own schooling, recreation, and so on, despite the limited size. And these had to be financed largely by the real estate venture, as turnkey public facilities.

(Slide) In our analysis of the program objectives, we arrived initially at an approximate 40-60 mix of below-market and above-market dwelling units, and approximately 26 percent of the housing units were to be in family sizes of three, four, or more bedrooms. Because of the existing site context, as well as the need for user attractions, we felt we had a requirement to provide an on-site K-3 school, preschool, a swimming club, extensive recreation facilities, a small park for both residents and off-site users, and local commercial activity.

As we will see later, however, the high costs of development were such that we had to go even beyond simply supplying local amenities to include, on site, some revenue-producing commercial office uses in excess of neighborhood convenience needs in order to finance the amenities of this development.

(Slide) We looked at various kinds of relationships among the families that were programmed for the site and the kinds of facilities that they would require. With the help of computer programming, we went through many different combinations of the dwelling unit mix as well as the community facilities. These were also tested in terms of the holding capacity of the site. Following these computer tests, we made three-dimensional mock-ups of a wide variety of schemes from 300 units, up to 700 units, with various compositions of facilities.

(Slide) The scheme that we settled on after the first three or four months and which gained initial approval from local authorities and the community groups is shown on the left.

It is a scheme which can be characterized as a residential "mega-structured," but with enough articulation of some of the nonresidential facilities to make some concession to a problem of which we were then only dimly aware--that very few of these high-density building systems would be capable of accepting parking, shopping, schools, or other mixed uses at their bases. Nevertheless, we felt that in order to get the densities on the site that would achieve a total optimum relationship between costs and revenues, we had to have a rather high degree of connectivity and multi-level integration among functions.

(Slides) Here you see (on the left) several of the sections in that preliminary concept. On the right is the conceptual massing which was fitted out for two Housing Systems Producers building high-rise slabs on the extremities of the site, with a third Producer to provide the larger proportion of the family-sized units as well as a high degree of architectural continuity. Low-rise groupings for each of the three Producers were offered as foils against the larger massing.

We felt that in the design concept itself, we had to pick one of the systems to be, let us say, a friend of the site designer by putting him in such a position that, together with the open space, circulation, and community facilities, we would have site-wide physical connection and a commercial service systems, as against what would otherwise be an odd-ball assortment of individual buildings.

(Slide) These are showing various floor plans. On the left, the plan at grade, showing some commercial uses on the left side, parking behind the structures. The plan on the right shows the level above, with open space above parking, and so on.

(Slide) Now we had a series of basic organizing principles upon which this scheme was based. One was a continuous socializing link through the whole site that would provide access to dwelling units, particularly those of family size, as well as all entry elevator cores, and off of this most of the community services were organized. A large part of this pedestrial circulation and open space was raised above parking and offered views of the New York. We provided complete continuity of pedestrian movement down to lower levels where it would tie in with shopping or on the other end of the site with open space and schools.

(Slide) The project must not be an island, but must be enterable from all directions. Its on-site community facilities should also serve off-site residents, particularly the K-3 school.

(Slide) A very strong principle was that all of the residential units had to have some kind of view, hopefully of New York; if not, of New Jersey marshes.

(Slide) Open space location was determined in accordance with the feasible scale of building open spaces on top of structures, or at grade, as well as by some concept of creating a family-oriented environment on one end and the commercially-oriented environment on the other.

(Slide) The red dot shows the commercial uses. This is the financial "grease" that helped this project to get into the realm of the possible.

(Slide) The big blue circule is the location of the K-3 school supplying the needs for school kids in that age category for all residents as well as that much again for off-site residents. The brown represents swimming facilities and various other services such as preschool.

(Slide) The interaction between social groups and these facilities became an important principle in the location of these homes. For example, the preschool on the right indicates one of the many facilities which became a determinant of where certain family-type apartments would be located.

(Slide) A very considerable concern was the programming of dwelling units according to vertical and horizontal circulation and the position of the dwelling units in relation to these socializing elements. All family-sized units were provided with at-grade entrances, and most would have private open space.

(Slide) At this point within the framework of that plan, we were introduced to the systems producers, three at that time: Descon-Concordia from Montreal, which would conform to the description given by Mr. Testa of a horizontally-structured software approach; CAMCI, which is an American franchise of the French Tracoba system; and Townland which is a consortium based in New Jersey. Some producers were surprised to find the plan so far along without their having been consulted. We went through a certain amount of waltzing around to find out the extent to which each Producer would play the role that was assumed for it in the plan.

Modifications were made as a result of these conferences. Townland did not wish to play the key "route building" role. Descon-Concordia from Montreal, which was a software organization, welcomed this rather unique design challenge. So, Townland took its position on the eastern edge of the site and insisted on the ability of breaking its mass up into a series of variable-size elements, simply to demonstrate it could be built in various sizes. Within that framework our organization worked out various controls and assignments for all three producers.

(Slide) This is showing some of the variations which were made in the plan in order to accom-

modate the desires of the Townland Corporation.

Within the agreed-upon plan we then went to work to develop a specific set of program objectives and performance specifications for each of the participant systems. The entire scheme was broken down into basic envelopes. Within each envelope was defined a series of programmatic ingredients and performance criteria.

(Slide) This shows an example of the dwelling unit mix that was assigned to each. On the right are some of the qualitative statements made with respect to such things as views and the relationship of the dwelling units to circulation, et cetera.

We had a basic principle for the ongoing design process that certain elements would not be further controlled by the site designer, but would simply be a matter of the Housing System Producer fulfilling program objectives and performance specifications. For other, more crucial elements, there would be a design review process. In order to assure maximum design integration of the collective public environment, the Prototype Site Planner was assigned the architectural role for design of schools, shopping, swimming club, open space, circulation, some of the parking lot under any of the apartment structures, and all of the graphics and open space treatment. Through this positive design role, the necessity for restrictive reviews of architectural interpretations by the three Producers was minimized.

Within the framework of what we called "Design Guidelines for Housing Systems Producers," four different sets of architects, under the coordination of the Developer and coaching in parallel from HUD technicians, went happily forward for approximately six months. On our part, we went forward with the architectural services for the nonresidential facilities as well as certain coordination and minimal review services.

During this period there was a sense of euphoria among all the Jersey City site participants. We had reported our several costs to HUD, but none of us were aware of what HUD's resources for the so-called "overcosts" were sufficient. We went happily forward with rather detailed aspects such as the public environment design, landscaping, graphics, and so on.

This euphoria was deceiving. The original concept of a mixed-use kind of environment was already beginning to get in trouble in the case of the CAMCI structure, where our organization was trying to design a shopping center partly sitting under a tower being designed by Skidmore, Owings and Merrill. Enormous efforts were made to adapt this tower so that it would permit wide spans for a decent supermarket, to no avail. The cost of accommodating parking under the apartment structures began to reveal themselves, and they were enormous. Townland began to offer bid costs for construction which suddenly made HUD begin to take a second look.

(Slide) Townland is a system with one of the most exciting concepts of mixed land use currently offered in the housing field, the so-called "SLS deck" system. Every three floors provides an artifical piece of land on which town houses with their own gardens can be placed. Obviously, it is redundant in structure; and costs came in quite high.

(Slide) CAMCI is a system more typical of the current systems building field, a wet concrete pre-cast slab system.

As you know, this system produces very heavy shear structure requirements. It is difficult to bring in for low cost, especially on the small quantities being produced here in a mixed-use kind of situation.

(Slide) Descon-Concordia has the most flexible approach because it is a software approach, making use of modular principles and precast slabs, but able really to eliminate many of the rules that other patented component systems use. Nevertheless, it was unable to show a past track record on its costs and played the gave very honestly during design-phase cost quotations; and these were high.

(Slide) So, HUD called a stop at the end of February 1971 and said we must redesign totally. And since there was another system, the Shelley system, then developing at Memphis precast concrete boxes already in Puerto Rico, which was quoting good prices, it was suggested that we should work out a plan by which Shelley could take a part of the burden of producing the 500 units of housing at Jersey City.

(Slide) This is the Shelley system. It is quite simple in its concept and bases itself upon repetition. However, it obviously raised questions with respect to the rather varied environmental quality goals we had proposed for the site.

(Slide) At this point there was a rather interesting technological experience for all of us. Now began a process of serious redesign and negotiation between systems producers, developer, HUD, and the site designer.

Our office had one team in New York for several days with a 3-D model and cost data,,another team in Philadelphia with counterpart d-D models and linked to New York by a Telecopier, and teams of designers and cost estimates in each of the offices of the systems producer were also at work. Each team was designing and costing simultaneously, all of it being coordinated at the design-costs maneuver board and bargaining session in New York.

We went through various alternatives from the simple to the complex, starting with the basic truism that the cheapest buildings are the high-rise towers with small apartments. But Mr. Finger of HUD was the first to suggest that a simplistic composition of towers was just entirely too unchallenging and worth the effort. So then we went into another variation in which we used the Shelley system to create a watered-down "route building," giving Shelley a larger percentage of the units because its prices were being quoted somewhat lower.

(Slide) Then we looked at various other versions in which we reintroduced Descon-Concordia, which had very good designs but higher prices. We tried to see if we could work out a feasible program by which Descon-Concordia was given a larger critical mass of units, with two other Housing Systems Producer (CAMCI and Shelley) building two simple high-rise slabs.

(Slide) At this point, HUD asked that Townland be reintroduced to the complex. Ultimately, we came out of this four days of bargaining and redesigning with four Housing Systems Producers rather than three. On the left you see the basic scheme which was hammered out during those days on the Telecopier and on the right you see its further development. From that point things went forward to a very detailed level, complete to construction drawings, bidding and start of construction on one or two of the systems. At that point prices coming in on Townland were once again too high. A second stop order from HUD was issued in September, 1971.

(Slide) Here you see the Townland structure and the Shelley building, as they appeared prior to September 1971. At this point the schools were no longer under anybody else's building, but the school and pre-school building being designed by our office was being used as an element of continuity to link different high-rise apartment buildings in a way that would reduce the disparity of scale between them.

(Slide) At the present time, we are going forward again with three Housing Systems Producers, filling out the hole left by the Townland Corporation with an expanded Shelley participation. As I said, several systems are under construction. However, the process has been a searing experience from the standpoint that it has not demonstrated that systems building is yet responsive to environmental criteria such as mixed use, wide variety of family sizes, user choices, ability to produce continuity in the public environment, and so on.

The process has been slightly delayed as is suggested by this comparison between the schedule and process as we saw it back in the honeymoon period of May 1970, and as the schedule is now forecast for the rest of the project.

(Slide) We have had a complicated organizational process. HUD's and everyone else's original objectives have been impacted by the difficulties of so many performers in so small a space and all in a jurry. What was to have been a rapid schedule has turned out to be very slow. Perhaps the most telling indicator of our efforts in the successive redesigns has been the progressive diminution of the family living qualities in this high density project. This is a chart of the dwelling unit mix in successive design changes. January of 1970 represents our entering program; June 1970 represents the program as it was negotiated with the three Housing Systems Producers when we first got together; March 1971 represents the program after the Telecopier marathon; and November 1971 represents the

program as we have it today. The count in large bedroom units has gone way down and the mix is very much a conventional high-density housing mix. So perhaps our key objective, which was to demonstrate that families can live in high density, was not fulfilled. We did manage to keep hold of the entire program of community facilities minus some open space and with some of the parking in open lots, and we did manage to make a feasible land development. The infeasibility has really been in the building systems! They have not provided the means for an architecturally superior environment of mixed-use buildings, large at-grade family units, 100% structured parking, and maximum open space.

We still have a few breakthroughs in front of us. (Laughter.)

QUESTION: How did the cost of this job work? At what point did you know what sort of a budget you were working toward?

MR. CRANE: The accounting was in two different pockets, one of which we knew and one of which was known only to HUD and partially to individual Systems Producers with whom HUD negotiated individually.

The one pocket was the normal FHA mortgage financing pro forma. In effect, all of the residential units are receiving their cash input from two different sources--the normal amount that the mortgage proceeds will justify, and an additional amount from HUD to pay for the overhead of developing the prototype.

None of us knew the amount of "overcost" available from HUD until those frenetic days of the Telecopier last March.

QUESTION: Is there any idea of how the costs of system building as they have been demonstrated would have compared with conventional construction?

MR. CRANE: I think in this particular case it is very difficult to generalize because such small quantities are involved with each of the systems. One of the primitive areas of industrialized building is the ability to reliably quote prices as they will vary with quantity, location, and situation. I dare say at this moment few of the Housing Systems Producers are much closer to an answer on that than they were before Operation Breakthrough.

QUESTION: How are you dealing with economic needs of people?

MR. CRANE: We are basically using FHA 236 and the rent supplements approach to piggyback on top of urban renewal write-down on the land to meet the lower range rentals, as well as other FHA financing for middle and upper income. This rent supplement component is brought in on an "invisible" basis in various proportions to each structure, depending upon the number of families in the below-market category and upon the bedroom sizes of each design.

QUESTION: Do you have any personal comments on the practicality of this kind of integration scheme without creating an incident which is strikingly similar to bussing as a technique for integrating in ghetto situations? In some respects I see a similarity to combining groups which don't normally go together, by designing a complex which will take them all.

In fact, there is that similarity. If people can't get together naturally, you put them together in a specific design created for that purpose. I am just a little skeptical bout the practicality of this kind of an approach.

MR. CRANE: Are you skeptical of the desirability or the practicality? I am skeptical of the practicability, I am not skeptical of the desirability.

VOICE: No, I am not skeptical of the desirability being unnatural. But in this particular instance you are creating a situation which may not be practical in that respect.

MR. CRANE: Well, this happens to be a site which is at the confluence of three different ethnic and racial groups, but the neighborhood is in the moderate to middle-income range in all ethnic groups which are tangent to it. From the site, it is a five-minute walk to downtown Jersey City, and so easy to get to Lower Manhattan. I dare say that if there is a site that has a chance of mixing groups both racially and economically, this is it. But it will not happen without conscious policy and inducements. In all of these kinds of problems the key is what carrots do you supply that cater to those who have a choice not to live there namely, what do you do for the middle and upper-income that causes them to live there? Thus our heavy emphasis on schools and open space, a swimming club, putting the cars out of sight in structures, and so forth.

QUESTION: From the inception of the choice of Breakthrough systems, could you elaborate just a little bit? Did they actually live up to what they said they would do when they were chosen? We heard cost wise they had a hard time. How about environment-wise, structure-wise?

MR. CRANE: Well, I am impartial with respect to the producers that are on our particular site but I will say that I am favorably impressed with one out of our three from the standpoint of cost claims and representations; that one plays it conservatively, sometimes to its own disadvantage.

QUESTION: Would you say this is a trend?

MR. CRANE: It happens to be a very honest group which do not make claims that they haven't yet got a track record on. Therefore, they suffer a little bit in the political process of claims, because they are unwilling to make very low-cost claims until they are proven.

QUESTION: As an experiment or prototype, would you care to speculate as to how far away we are to do this on a practical or large-scale production?

MR. CRANE: I think that what we set out to do environmentally-speaking in Jersey City could be done tomorrow if we had a much smaller group of participants, a building system that was much more flexible in its structural preoccupations, and if there was the same amount of concern as HUD showed here with the whole issue of the total community facilities and the organization of the financing. This is not radical--none of these are radical in their architectural concepts. What is radical in intent here was really the land use concept. And HUD was the inspiration and guardian of this environmental design innovation. Building technology and imperfections in organization of the process prevented a fulfillment of HUD's intentions.

VOICE: You mentioned there was about a two-month lag before the actual system producers came in.

MR. CRANE: Right.

VOICE: And that they were concerned about that. To what extent do you think that was an appropriate lag or should they have been in immediately?

MR. CRANE: I think that we at least should have known who they were and what their characteristics were. We did not know that until one month before we had to present our concept. At least we should have known the performance capabilities of each system.

Presently we are going forward to work with developers in new Breakthrough situations for so-called Phase III, in which the task is to take a site and, having developed a program for the site, evaluate on an open-ended basis which systems are most likely to be able to deliver the particular requirements of that site. This is a different problem because you are fitting a system to a set of objectives that have been fashioned for a particular situation.

QUESTION: Earlier, you made a reference to community approval. I was just interested in fact to what extent the real user of the facility was involved in any of this along the line and what form would that community approval take? Secondly, given the quite obvious degeneration of the scheme through time, do you feel that you could reach a point where it really wouldn't make sense to do it at all, or would you accept that possibility?

MR. CRANE: In March 1971 I fully accepted that as a possibility. The first high-rise towers alternative I showed and which Mr. Finger vetoed--if it had been the basis of the policy as we went out of the four-day redesign session, would have caused many of us to question the value of further efforts.

As far as the user involvement, the ultimate user was not involved. Jersey City is characterized by rather old-fashioned democratic politics in which it is not customary for citizens to be involved. (Laughter.) And perhaps this was one of the reasons why Jersey City was chosen.

I don't know.

Several sites were bombed out of existence in the Breakthrough program by community opposition before projects even got started, such as Wilmington, Delaware. But I would just offer the suggestion that it is rather difficult, in speculative housing, to involve the ultimate user. You can involve the affected community, but it is indeed difficult to involve the ultimate user. So we begin to need new kinds of research and design processes for getting at the question of user wants, and behavior.

PROBLEMS & METHODS OF LOW COST HOUSING

JAN van ETTINGER, Jr.
HOLLAND

Let me start to say that I do not answer the definition, although I am an engineer, which Colin Davidson gave this morning. Perhaps this is due to the fact that, as an architect, he doesn't sufficiently know the truth about me.

I am a mechanical engineer; that is to say, I am professionally an outsider in the building industry. Therefore, I would like to paraphrase the definition of Colin Davidson to fit myself. I am somebody who knows nothing about nothing, but something else. (Laughter.)

I have been invited to present a case history. Although I am going to do this to a certain extent, I resent it a little. First of all, I think historians are reshaping the past, whereas what we should do is shape the future.

Secondly, I am going to work with statistics. As you know statistics are comparable to bikinis; what they show is suggestive, but what they conceal is essential. (Laughter.) Since the comparison is made to bikinis and not monokinis, you can see that this is a rather old definition. (Laughter.)

I am going to first show you some slides which try to illustrate my country, the Netherlands, in the period 1961 to 1970. I have taken this period because, in United Nations terms, one might say that this has been our first development decade and has laid a basis for a second development decade just starting.

(Fig. 1) On this series of slides all the graphs have as an axis the years 1961 to 1970 included. The first graph shows the gross national product in billions of guilders which has risen from about 45 to over 110 in this period.

The lower line is the investment in housing. Perhaps more important is the second line showing housing as a percentage of the gross national product. This has essentially varied in this period from a low of about 4.3 percent to a high of about 5.6 percent.

What we can learn from this graph is that if we want to try to attempt to solve the housing problem, we have to keep in mind what percentage of our gross national product we can invest.

(Fig. 2) The second graph shows the increase in population which has been rather low in our country, just over one percent on a yearly basis. It also shows the number of dwellings completed per year. It is a pity that the preceding period

Fig. 1

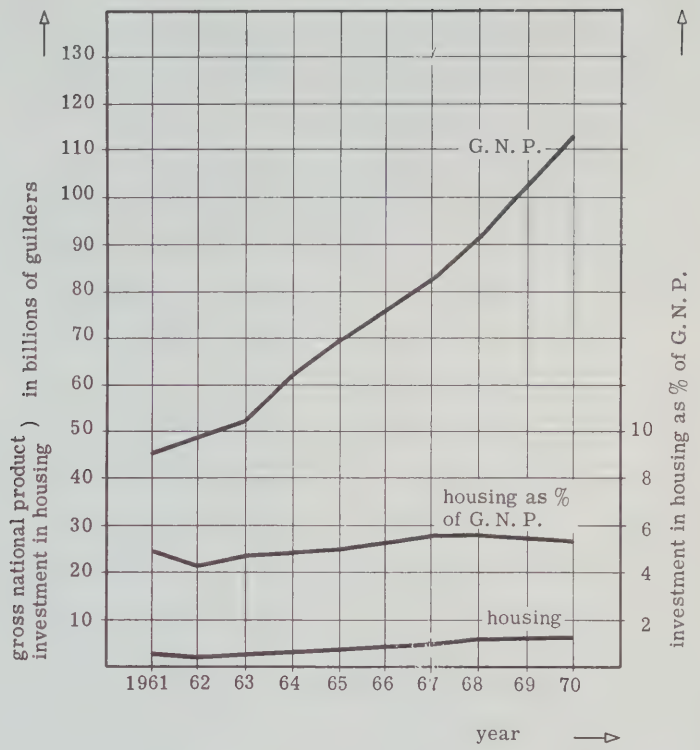
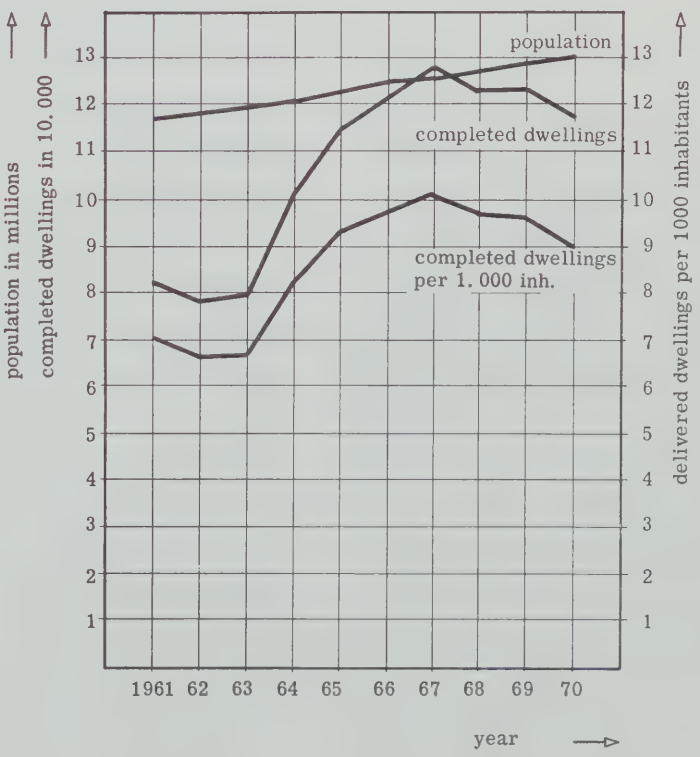


Fig. 2



isn't shown, but we came out of a period which was fairly stabilized at 80,000 dwellings a year. Due to a very active new minister, our government managed to push up production in four years' time from 80,000 dwellings to nearly 130,000 dwellings a year.

This is perhaps better expressed in the number of completed dwellings per thousand inhabitants, per year, which increased from about 6.5 to over 10 in 1967. Ten dwellings per thousand inhabitants per year is the target we have to aim at if we want to solve the housing problem in the long run.

But you see the disastrous effect of discontinuity in government policy--after 1967 the production level has dropped from over 10 down to about 9 dwellings per thousand inhabitants per year.

(Fig. 3) The third slide illustrates the same period of 10 years during which we had an essential increase in the quality level of housing. Two factors illustrate this. One, the effective floor area has gone up from about 620 square feet to over 740. Second, the percentage of housing equipped with central heating has gone up from about 15 percent to over 90 percent.

(Fig. 4) What you see on this fourth slide is the line you saw earlier of the number of dwellings completed per year, but combined with the number of laborers in house-building on site. This gives an indication of what has been done for productivity.

We had a low point in 1963 of less than 1.1 dwellings per laborer per year. This has gone up in the period of the stimulating Minister of Housing to nearly 1.7 dwellings per laborer per year, notwithstanding the increase in quality, as was reflected by the preceding slide. But here again is shown the disastrous effect of discontinuity in government policy--after 1967 the productivity dropped from around 1.7 to around 1.4 dwellings per laborer per year.

This productivity question is, of course, extremely important. As is expressed by simple economic laws: man can only have what he produces and so if we do not increase our productivity, we cannot increase our production and, therefore, we cannot satisfy our needs.

(Fig. 5) This last graph about our first development decade illustrates something very basic. You see the two indices; one is the index of the cost of living and the other is the index of building costs of dwellings.

Suprisingly, it has been possible for one year to keep the latter at a constant level, although the index of the cost of living has gone up. What is more important, the rise in the index of building costs was more than double the rise in the index of living costs. The cost of living, furthermore, includes the cost of housing; if we exclude that from the index as shown here, we find that the building costs have gone up three times as fast as the cost of other consumer goods.

Fig. 3

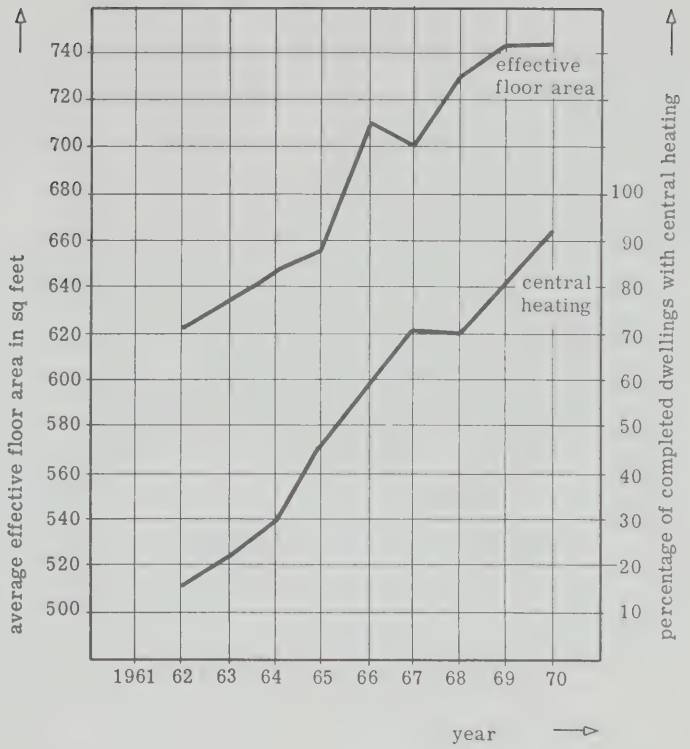


Fig. 4

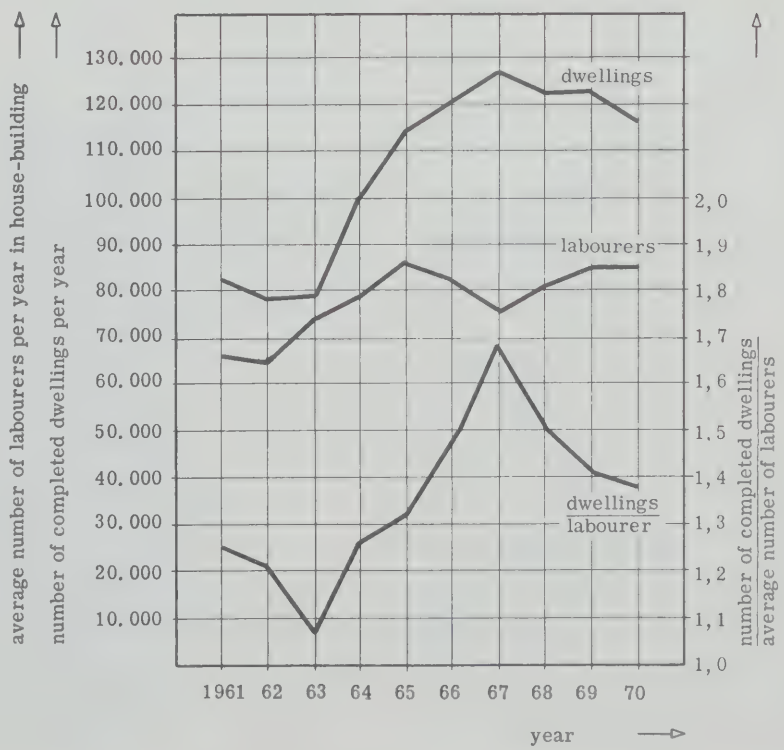
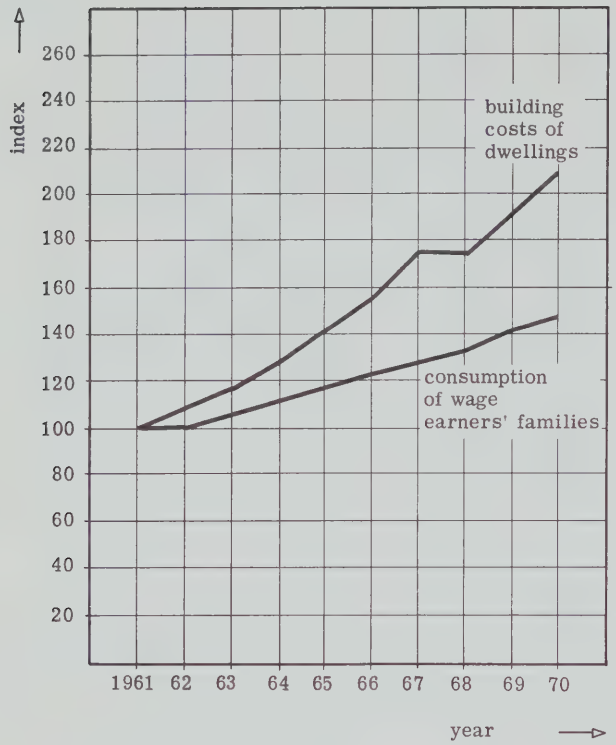


Fig. 5



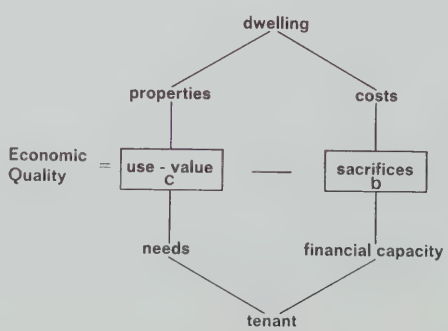
I think this is an extremely important indication. It is disparity we are fighting already for many years. All of us who do work in the building industry should realize that we are confronted by a system of competing markets. Many contractors or architects or other professionals in the building industry are afraid of the competition within the industry. However, I think we should be much more afraid of the competition between the industries. If we go on like this, we will find by the year 2,000 that all of us have a car, a refrigerator, a TV, etcetera, but have no decent housing. The building industry should realize that, although it is catering for so-called social goods, it should obey the same laws of competition as other industries and that it should produce value for money.

(Fig. 6) To illustrate what I understand by value for money, I would like to give you our definition of quality. This definition of quality basically illustrates that the quality of a product does not have an absolute value, but a relative one.

The quality of a dwelling as such, we cannot define. We can only define the quality of a dwelling, including the environment, in relation to a certain tenant or a certain family. If we look a little more carefully at the relationship, we see that at the side of the dwelling we have to deal with properties and costs (of use). At the side of the tenant or the family, we have to deal with needs and financial capacity. The needs of the family are opposed to the properties of the dwelling. This opposition determines the use value; or the way in which that tenant, on the basis of his needs, values the properties of that dwelling.

The opposition of costs (of use) and financial capacity determines the sacrifices; that is to say, the way in which the tenant or the family feels, on the basis of his financial capacity, the costs of that dwelling. Quality is now defined by use value minus sacrifices. To illustrate this relativity of quality, take the following example. If I put a Rolls-Royce here and myself there, the use value of this Rolls-Royce to me might be positive, or it might be negative, because people would't accept that I would drive around in a Rolls-Royce. However, let's assume for a moment it is positive. My financial capacity, however, is not such that I could ever bear the costs of the Rolls-Royce. That would mean that the sacrifices for me would be bigger than its use value and thus the Rolls-Royce would have a negative quality for me.

Fig. 6



If at the other hand we would put a Volkswagen there and a captain of industry here, we would find that the sacrifices for that captain of industry (at least if his industry is successful and if he is a real captain) would be rather low because the Volkswagen is cheap. But the use value to him might be so low that again we have a case of negative quality.

What we should aim at is so-called optimum quality.

(Fig. 7) On this axis we represent the quality level, which does not have a relative but an absolute value (for instance, the number of square meters in a house); a house of a hundred square meters has a higher quality level than a house of 90 square meters. If we have a monetary unit on the other axis (for instance, dollars) we will find with increasing quality level that the use value will increase very much in the beginning, but less and less later. On the other hand, the sacrifices will increase little in the beginning, but more and more later. We will find a certain quality level, which we call optimum quality, at which the difference between use value and sacrifices is a maximum.

This is what we should aim for, because any other quality level involves waste. If we go to a lower quality level, we will find that what we lose in use value is more than we save in sacrifices. If we go to a higher quality level, we will see that what we win in use value is less than we have to spend in sacrifices. So, both situations include waste as compared to the optimum.

Now I come back to our three topics: one is the reaching of optimum quality; another is having to produce quantities which even for so-called developed countries are rather staggering, being at least 10 dwellings per thousand inhabitants per year; and last, but not least, is working at cost levels which are extremely low. If we combine the 10 dwellings per thousand inhabitants per year with roughly 5 percent of our gross national product, which can be invested in housing, this means that for the United States the average investment in a house should not exceed $25,000, including the cost of the land. If we do not obey these rather simple laws, we will find that we cannot achieve our target of 10 dwellings per thousand inhabitants per year.

To find a solution for this extremely hard problem, we need a very modern, sophisticated working method which I will try to explain to you.

(Fig. 8) This method should take society as its starting point. This slide has been colored green by us for two reasons. Green is the color of hope, and secondly we hope that society will stay green.

Fig. 7

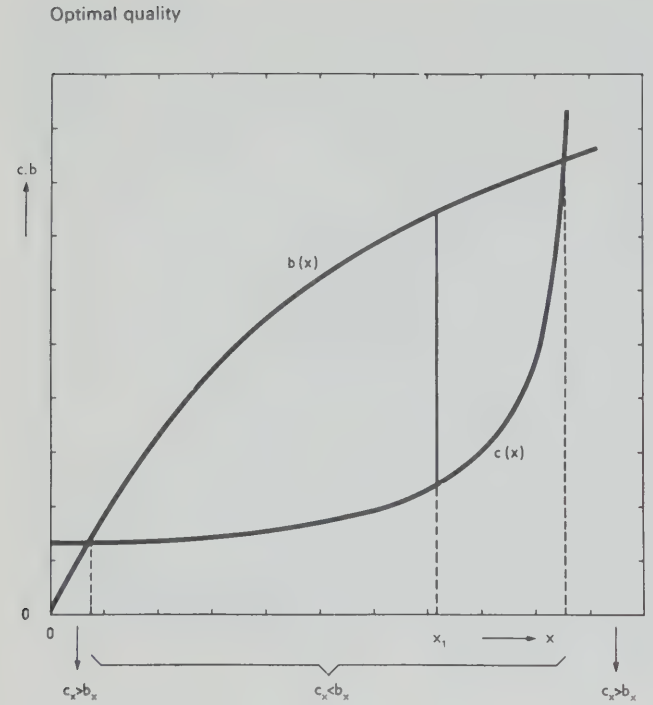


Fig. 8

(Fig. 9) In this society we should see man as the center of all our action.

(Fig. 10)In connection with this definition of quality, we have to reckon with man's needs and financial capacity.

(Fig. 11)And these are opposed, as I explained already, with the properties and the costs (of use) of a certain dwelling. This should be done in such a way that we get optimum quality.

(Fig. 12)We should use two very important tools to achieve our aim: rationalization and standardization. We think that such matters as prefabrication are rather unessential for rationalization, although they can be the best solution in a certain situation. Rationalization is basically on the one hand the improvement of our use of tools and equipment, and on the other hand the promotion of the continuity of our actions. Especially in striving for continuity, standardization is one of our basic tools.

I would like to say two things about standardization. First of all, you know, perhaps, the definition that Mr. Ford gave in 1909. He said the consumer can have any color car as long as it is black. This is a rather extreme approach. But at least we have to admit that Mr. Ford must have been the first man in this country to have said "black is beautiful." (Laughter and applause.)

Secondly, although we are afraid of standardization, the situation today is that we have monotony without standardization. What we should achieve is a standardization without monotony.

We have started in our house-building industry with the kind of extreme standardization Mr. Ford was pointing at, but we are arriving nowadays at a kind of a standardization which is more comparable to what the modern car industry is doing. That is, we started in 1955 by producing one type; nowadays we are starting to produce a "family of types."

(Fig. 13) To illustrate what rationalization and standardization can do for us as tools, this graph illustrates the serial size and the number of man hours per dwelling as utilized at the building site.

I must remark that these graphs are based on so-called traditional construction; also that they are based on somewhat smaller dwellings than we build nowadays.

If we produce the same type of dwelling (and this was at the time that we were producing one type in one series), but give no specific attention to the efficiency requirements to be fulfilled (from the point of view of extension plan, design of the dwelling, and organization of the execution), then the first dwelling costs about 2,600 man hours. This drops down to about 1,200 man hours for the two hundred and fortieth dwelling.

You see that the average over 240 dwellings is just under 1,400 man hours per dwelling, or about half the number of man hours we used for

Fig. 9

man as the centre

Fig. 11

properties and cost of the dwelling

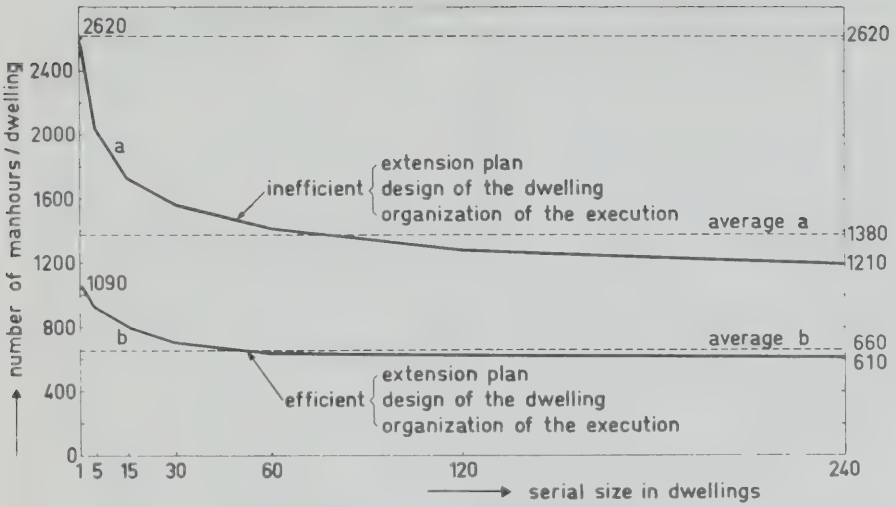
Fig. 10

man's needs and financial capacity

Fig. 12

rationalisation (industrialisation)

Fig. 13



the first dwelling. However, if we give optimal attention to the efficiency requirements to be fulfilled, we find that we need only about 1,100 man hours for the first dwelling and that this drops to about 600, with an average of 660 man hours.

Thus, one could say that inefficient repetitive production over a sufficiently large series cuts the number of man hours in half, and that efficient repetitive production cuts this in half again. These man hours might seem surprisingly low, but I have to add the following to this: in my country the only building method which really can compete with traditional construction is "cast-in-situ concrete." At present this method, if well organized, results in no more than 500 man hours on site for a dwelling of 100 square meters.

(Fig. 14)In addition to rationalization and standardization we need teamwork. We do not consider a team of five architects to be teamwork; that is about the same as five housewives in one kitchen; it doesn't work. Teamwork means that all partners in the process, the client, the planner, the architect, the contractor, specialists, and last but not least, the user work together in one team during preparation and execution of the project.

(Fig. 15)The first step is to carefully subdivide the decisions we have to take throughout the process into six consecutive stages. One is setting the objectives, for instance, what type of dwelling for what type of family at which location, at what cost, which size, et cetera.

These objectives are formulated in commercial or market-oriented terms. On this basis we work out a program of requirements which is phrased in functional or user-oriented terms.

Other decisions concern the design, the production, the distribution, and the service stages.

Why do we put so much emphasis on decisions? Mr. Thant has said it very well; perhaps the biggest revolution we have undergone is having thought that our resources determine our decisions--to come to the conclusion that our decisions determine our resources. What we should do, then, is have an optimum process of decision-making.

(Fig. 16)With this approach, certain stages of decisions are so important that we should first test out their validity before proceeding to the next stage. For instance, if we have our design, we should translate the design into a functional, full-scale model; test that out, and feed back the experience to the design, and in extreme cases even to the program.

Only after having tested out the design with a functional model can we go on. The same is true about production. Before we can come to actual mass production, we first have to make an experimental series to test out our tooling, to test out the training of the laborers, and to test out our overall organization. This again gives a feedback to the actual production process.

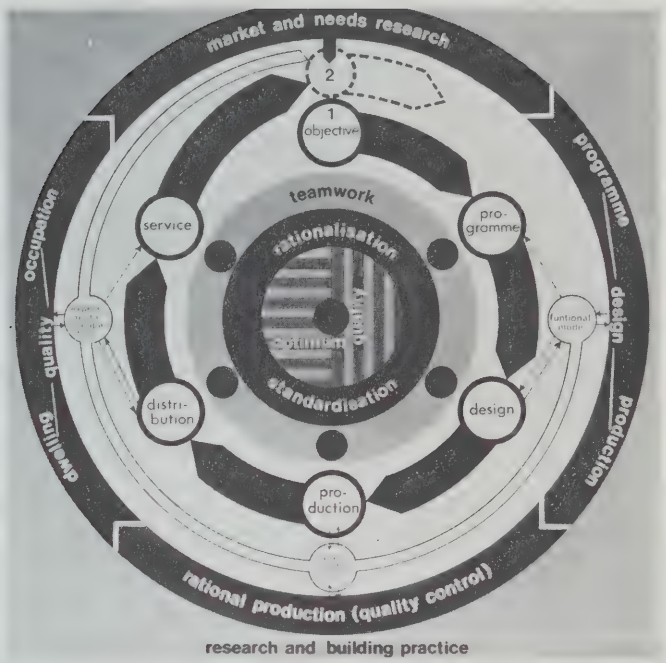
Fig. 14

Fig. 15

Fig. 16

experiments and feed-back

Fig. 17



research and building practice

(Fig. 17) A third stage for testing comes after we have produced an experimental series which is into actual materials. We can use that series for experimental occupation, the results of which are fed back to our distribution process. This is very important because in the distribution process we realize the actual contact between the dwelling and the family. Secondly, during the distribution stage we should instruct people as to how they can use the house in a functional and a technical sense. Experimental occupation can also form a feed forward to our service stage. Although our decision and our action processes are extremely important, deciding and acting are not enough. We also have to think; we have to do research. With regard to research or thinking, we should keep in mind that the human brain is the cheapest building material in the world.

We should have more intellectual investment in house-building and building in general, so as to achieve better and cheaper results. Certain sectors of research are of specific importance: market and needs research which has to form an input for the objective; research to sustain program, design and production; research into rational production, including quality control; and research into the quality of the dwelling after its realization and into the quality of its occupation.

(Fig. 18) All this research forms an input into our decision process. Our experiments, our models form a kind of translation between the action and thinking processes.

Fig. 18

(Fig. 19)In all this, we have to take society as a basis and man as a center, and participation, as is indicated by these arrows, should not only play a role within the team and its decisions, but also in the experiments and even in the research.

This method as a whole we can call the development cycle method, because when we have fulfilled one cycle, we should go on for the next cycle. If we have done it the right way, we have learned so much about the first cycle that the second cycle can be started at a higher quality level.

The method in its totality has not yet been completely applied by us. There have been two rather extensive applications in the Netherlands in which most of the elements were applied and there have been a couple of applications in so-called developing countires. This higher intellectual investment leads to the following: to express it in quantities, if we are willing to increase one percent in intellect, we can save 10 percent in costs and can raise the quality level by 10 percent.

This one percent seems very low as compared to the car industry, not to talk about the cosmetic industry, but one percent in research and development costs is very high for the present building industry.

In my country it is not much higher than 0.1 or 0.2 percent. I don't think it is much higher in the United States. So, we have at least to multiply our research activities by a factor of five to 10, not Ivory Tower research, but research which is very much oriented toward the decision-making process.

(Fig. 20)A method as such is not sufficient to solve the problem. You, as we do, also need an Institute. We have to recognize that in most countries in the world the building industry is very fragmented. There are many partners; they are uncoordinated and uncooperative. Some kind of a center is needed which brings people together not on an incidental basis, as is done here, although this is very valuable--but which forms a more institutionalized platform for all participants in the building industry.

It can only form an institutionalized platform in a successful way if it is independent from the different partners in the building industry; independent from government, from planners, from architects, from contractors, from manufacturers of building materials, et cetera. If it is linked to one of the partners, it tends to defend certain interests, and cannot perform an objective central function among all partners.

Our Institute, Bouwcentrum Rotterdam, has existed nearly thirty years now. It was opened as a more or less traditional building display center with a small information service connected to it.

Fig. 19

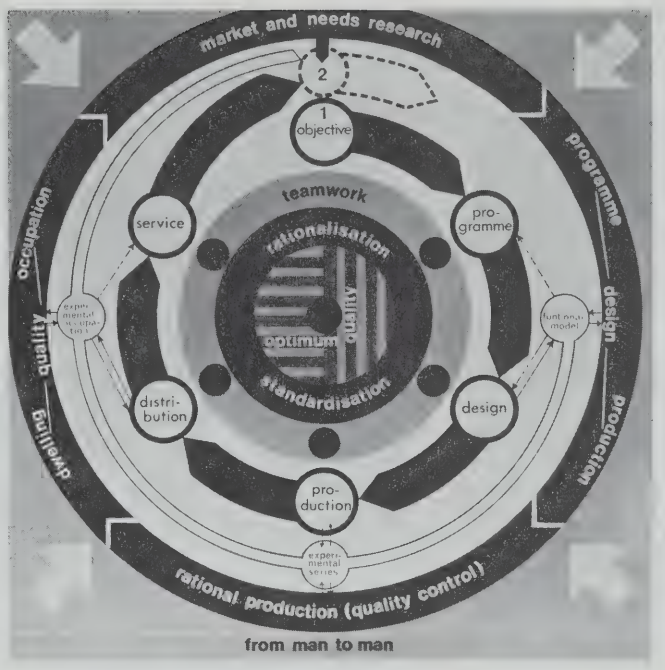


Fig. 20

Fig. 21

Fig. 23

(Fig. 21) Gradually we have grown. Our second building was opened in 1955. Our third building was opened in 1965, and our last building in 1970.

(Fig. 22) We could say in somewhat simplified terms that our aim is to promote more and better building. To "promote," since we have no legal power; we cannot tell anyone that he should do this or not do that. We can only go to people and try to convince them. "More building" may be clear and I hope that, "better building" is also clear after I have given our definition of quality.

(Fig. 23) Our first building is not a display building anymore, but to a certain extent, a gigantic workshop.

(Fig. 24) One such workshop is called Urbanoscope. With closed circuit equipment you can move a needle with a lens at different speeds through a model of a neighborhood or of a part of a city. This is projected on a TV screen and can be videotaped. It gives the sensation of actually going through the environment you are trying to develop.

You can make changes in your environment, run it through this Urbanoscope again, videotape it again, and compare the differences. The total equipment does not cost more than $25,000 which I think is a rather small investment if you really want to investigate environmental questions of important extension plans.

(Fig. 25) Another function we have in this building is conducting our international course on housing, planning, and building. We have given this course since 1958, and have had participants from about 60 different countries in the world, including the United States.

This course has been set up on the idea of development cooperation. I would like to tell you our philosophy on this, because I think it also applies to this Conference.

First of all, and in this I strongly underline what Mr. Robbie has said; we think that the problems of housing, building, and planning in any country can, in the long run, only be solved through local brains, local materials, and local labor.

Secondly, we feel that each country can learn something from another country. Poor countries can learn from rich countries, but rich countries can also learn from poor countries.

I sometimes have the feeling from my own experience with developing countries that we can learn more from the poor countries than they can learn from us, because we in the rich countries live very much in an extrapolation society. Our dwellings today are a hundred square meters and tomorrow they are a hundred and ten, but we do not basically change our concepts of housing and dwelling. We talk about houses and we forget about housing. We talk about trains and we forget about trans-

Fig. 22

Fig. 24

portation. We talk about telephones and we forget about communication. The problems in poorer countries, however, are so staggering that they are forced to think more about the basic issues behind.

Finally, development cooperation can only be really successful if each participant is convinced that he is the one who needs to change the most.

Thank you. (Applause.)

QUESTION: How is your Institute financed?

MR. VAN ETTINGER: Our Institute is a private, nonprofit foundation which has no subsidies. Basically this means that we are an industry of knowledge, which we have to sell to survive; but our income comes in different ways.

For instance, in the terms of research, most of our research is sponsored by the government--not in terms of subsidies, but the government acts as a client who contracts research to us.

If we talk about consulting, we have the normal situation of consulting fees. Concerning training, we have tuition fees. For exhibitions, we rent out space. We sell publications. So, we have many different ways of getting out income, all more or less contract basis. Although we are a nonprofit organization, we have to make profit every year, for two reasons: any kind of enterprise, whether it is a limited company or a foundation, needs certain financial reserves to survive bad times. Even more important, we have to make profit this year in order to be able to finance next year's activities for which we cannot yet find a client who is willing to pay.

QUESTION: Is there any basic difference in community organizations control in Holland and, say, what exists in North America?

You stress the involvement of people. I wasn't quite sure who those people would be. Does this suggest there is a greater contribution from the users themselves in Holland than there is in this country?

MR. VAN ETTINGER: Well, if I am honest, I have to say the scheme I have shown to you is theoretical, one for which we should aim. Practice is, of course, a little different.

I think there is a difference in participation between the United States and the Netherlands, but of a marginal nature. One of the main reasons we have increasing participation is a very down-to-earth one. We have been able now to solve, at least in certain parts of the country, the quantity side of the problem. As soon as that is done, if you are not very careful, contractors or developers may produce houses which do not sell like hotcakes anymore. At that point you get interested in what the consumer needs are; this is a rather cynical approach.

On the other hand, our society is very much changing, as your society is as well, especially in the areas to be renovated. In the downtown areas we get a very well organized participation--you could even say pressure groups--of those who live in these areas who resent the idea that they are just displaced by skyscrapers, and who want to force the government locally and centrally to renovate these areas so that they can stay there at prices they can pay.

So, especially in the areas where people already live, the participation of people is very much increased. It is also increasing in the sense of protecting our environment. People are not allowed to cut down a tree anymore. There will be picketers around it to prevent the cutting down of trees. You will have to change your design so as to preserve the existing trees. However, in general, I would say it will take another five to ten years to really be able to talk about a truly systematic user participation.

Fig. 25

IMPLEMENTATION OF A BUILDING SYSTEM

NEAL B. MITCHELL, Jr.
U.S.A.

About two weeks ago I was in the Royal Academy in Stockholm, and I was surprised because the entire student body showed up so they could walk out in protest against America. So if you walk out, I am not really quite sure whether it is against an American or whether it is because of this cocktail hour. [Laughter].

I propose to go back and take a building case and perhaps show you some of the trials and some of the problems associated with bringing it to reality, and perhaps give you some idea of some of the problems that you will face, some of the newer ideas that are being proposed. I think it is fairly safe to say that you can start off with the single assumption that if you are going to innovate something new in a technological sense, and attempt to see it realized within a very short period of time, you are ridiculous.

I think it was Bucky Fuller who said it takes 25 years for an invention to go from an idea to a reality. Let me point out that if you are working with the United States Government, multiply that by 10. [Laughter].

In looking at the problems of systems building, we broke it into a very simple matrix of setting up the three different types of systems that we could go through, either a frame or a panel or a box system. I think you had a very excellent presentation at lunchtime in terms of the French approach to a panelized industry.

We started out in looking at the technology and concluded that the dollars associated with a box system made that an inefficient way to proceed. That is, there are other people doing this and doing it well. We concluded that the concrete box was most prevalent in the Soviet Union where there was large capital and rather a gratuitous government, if you will.

As well looked around there seemed also to be ample technology in terms of panel work. The panel system made infinite sense when you could get an agrement system or a government with the attitudes that the French proposed.

So we took a look at the idea of the frame in terms of what ways we could go; and then we took a look at the various materials that are produced. Into that matrix you could introduce a wood material. If you take a look at our Operation Breakthrough, for instance, you will find that wood frames, panels and boxes were the most favored, probably because they are closer to traditional forms of construction. So, finally, we concluded that it would be interesting to explore some of the possibilities of the frame.

Now, the frame, in terms of steel or concrete and in terms of costs: we started looking at concrete. At the same time a lot of data came from some studies that were done of looking at the way people built, at least on a very small scale. Our idea was to move away from the high-rise, more glamorous heavy construction into a more typical low-rise, repetitive building system. The initial criteria that we were looking for was flexibility in terms of architectural planning, and that can be both an initial flexibility and an in-use flexibility.

We took a look at fire resistance, and things like acoustical properties, finish variations, and maintenance and changeability.

All of these lead to a technology and I propose to show you the technology first. Recently I got a letter from a very good friend who said, "Well, I really don't think the solution of housing is in the nuts and bolts, it is in the human factors." I thought that perhaps today it would be much more intelligent to begin with the nuts and bolts, and then show you how that can be modified to meet some of the human criteria, and how when you begin to modify that, you begin to raise the major problems associated with this type of building.

Our program was to work with a column-beam system, a simple frame. The key to the frame was to have a nonbearing wall system. The function of the wall system was to provide lateral stiffness, but not vertical stiffness. In other words, it was to be an environmental membrane, if you will, merely to keep out the climate.

One of the key criteria was that we be able to disengage the wall and change it over time, because we felt that one of the advantages of a good systems building in the future means that you can change the finish almost like you could change a sports jacket from day to day; the idea being that we could unbolt the old wall and bolt in a new wall system.

Next, that led to the assumption that all of the bits and pieces of the building ought to be shipped and delivered in a series of small, elemental parts, so that the elemental parts could be assembled on site.

Now again the philosophy was to move in two ways. One was to say that not only would you industrialize the in-plant facilities, but you could industrialize the on-site facilities in a way that the on-site became merely an assembly rather than a construction process.

A second key to the flexibility meant that we could go multi-story, which required the capacity of a joining system that would permit us to go up.

Eventually this thing would up with a possibility for expansion in X, Y, and Z directions. In other words, you could add multiple bays, you could add multiple stories and the thing could grow in three dimensions. Obviously the key to the system is that it can grow in each direction, and that the component parts are fundamental. In other words, the column of the first floor is the same as the column on the fourth floor. If there were more time, we could go through the neat little interaction diagrams of column behavior to show you that one story requires a certain amount of steel, and four stories require a cetrain amount of steel, and where both of these fall on the failure curve.

The key again was that you had four competitive elements that could be manufactured. You will note that I am primarily talking about a building system, a manufacturing system.

We next added to that the idea that we could vertically structure our mechanical services, so that there was a hole provided in the building in one vertical chase-- a relatively standard design. In addition to that space would be available for electrical conduit.

If your dimensions were fixed, the walls could be pre-manufactured, shipped to the site and snapped into place. Perhaps most importantly to closing an open system was the development of a precast concrete exterior wall that was nonstructural, for instance a half-inch concrete wall with metal studs behind it. Such a wall is finished off the way a traditional gypsum wall is finished. Interestingly enough it is lighter than the conventional two-hour, fire-rated gypsum for exterior wall; also cheaper.

This particular wall is one of the various parts of a technology system: columns, beams, and then a mechanical package and an enclosure package. Note that the enclosure package was flexible enough so that it could be considered an open system. The mechanical package built around a chase was flexible enought so that it, too, could be considered an open system.

Basically, our concept involved nothing more than a series of building blocks. Like everything else the assumption was made that the way the building blocks were used would determine how successful the total package would be.

We went one step further; we went to the point of designing the connection. Let me give you a better understanding of the connection. We used mining bolts with nuts at the end. We locked in place the top and bottom plate of the column; this fixed in a dead accurate position our top and bottom, or our control points.

So, you see, we went from the design stage or the diagram stage into the construction stage. The erection of the system in nothing more than a column with a steel crotch at the top. A beam with a notch in it goes together must the same was Lincoln logs go together.

The problem that comes up with this is that obviously it involves a large number of pieces. The choice was made to produce a large number of pieces for flexibility. I think that Norm Rutgers of Lenox Industries drew a very interesting little thing called a "flexibility wheel". He started to point out how you could get maximum flexibility in the structure and zero flexibility in the electrical:

you wound up with a building that had pretty close to zero flexibility. I think one of the things we were looking for is how could we increase the flexibility of the building itself and what was the penalty we paid?

And the penalty was obviously a large number of pieces.

Structured together the beam sits of the column-- or the crotch of the column takes the notch of the beam which locks it into position. The critical point is that when you add these second story columns onto the first story columns, you bolt the outside of the beam, and squeeze the top to the bottom. You can illustrate this very simply by merely taking a pencil and putting it on the edge of a table; and you push very, very hard on that pencil. You will find that after a point the pencil and the table will act together; in other words, it will act as a rigit frame; and basically this is what happens under such a configuration.

To go one step further, when you put the tie beam into this, or the two frames are connected by tie beams, you have a small pocket underneath which is filled with concrete. You wind up with a fully fire-protected structure. This is about a 4-3/4" by 6" column with the capacity of four stories, and a 7-inch concrete beam.

The system is open enough so it is essentially a three-dimensional grid. You can add stories on to it. It is sufficiently rigid so that with three stories in the air, it is determinant enough so that you can stand on it and you won't fall over. When you bolt it together, it becomes a rigid frame capable of taking horizontal loads.

The transfer of that technology said another thing, that, in addition to solving the problem, we could end the top of a column with a plate, so that at a later date we could come in, undo the four bolts, lift the plate off, and add a new story or a new column. The idea was to build a system that had the capacity to grow, and what we were really working on was the free enterprise system-- or the greed associated with what everybody makes on land, and the fact that, as land values increased, people began to change the use of land-- and our feeling was that if we could build a structural system that could accomodate change of the walls and the functions, and had the growability up to four floors, we could optimize the land use over a longer period of time. This in itself would make good sense to investors.

The problem is that nobody had done anything like this before. So the question comes up, it may be a good idea, but how do you really get it realized? In other words, how do you get it out of the laboratory?

Put together, the system is nothing more that a series of toothpicks and cards. What's exciting, at least the way I look at it, is that as the architect, one can begin to treat those slabs as either solid and hollow; or one can begin to look at building as a system by which, for example, you can make two-story spaces, which can become three-story spaces. In other words, the frame is sufficiently rigid that one can begin to do a variety of rather interesting things with vertical as well as horizontal space-- two things that we considered critical in terms of providing architectural flexibility, while at the same time developing a hardware system.

The hardware system is a neat thing, and we can talk perhaps for the next hour, if you want, on a hardware system. Perhaps more important is how does this begin to be used and why does one, why should one, justify that degree of flexibility?

I took a particular picture once-- I could have taken it on any number of continents; this one happened to be from South America, but I can show the same thing in Africa and Asia. You see television sets and refrigerators and tarpaper shacks. The thing that has always fascinated me in this is that everybody has been able to market their product except the architect. The architect keeps sitting back and saying, "If they will only pull the market together, and if the government will only get more involved and if somebody else will only do the work, you see, we think we can solve the problem."

We decided that if in fact there was a capability to buy a refrigerator and a television set, there ought to be the capability of buying chunks of space that did not cost $20,000; in other words could you begin to reduce the cost of the increment of space?

As we looked around at developing countries we found one very significant thing. In the country we are dealing with-- the U.S.A.-- cities are rotting and nobody is doing very much; but the so-called developing countries are in fact developing. They are expanding space and they are upgrading its quality. It is intriguing that countries with very few laws are in fact involving their citizens in making an investment, whereas we are stopping them.

The other thing that becomes terribly obvious when you look at housing other than housing that architects build, is that whenever people build, there is always the reinforcing rod protruding-- there is always the provision for expansion. It's almost like when an architect builds a building, he does not agree that such a thing as sex exists. You know, if you have got three kids, by God you keep them once you get an apartment.

I think it is the Parker-Morris Report from England that said that the answer to housing would be people designing spaces that could change with people's needs.

So we concluded that one of the pretty key things that we were dealing with was a componentized system which could be added on to and had the capability of growing as the family grew.

We also discovered while looking at the way other people were doing things, that the traditional, industrialized house using the concrete block, produced a rather sterile facade. Still it was a requirement by people to have some kind of individuality in the house.

So, the question was, "What could you put into a house, what could you leave sufficiently flexible so that you could industrialize as much as possible and still have the opportunity for some form of human expression, something more that a Pruit Igo, which is a broken window?"

The architects' traditional answer has always been-- and that's where the architects of Venezuela got together and convince the Dictator-- that they could solve his problem if he would only give them enough money. The Dictator wiped out all the slums and built multi-story buildings which are exquisite. In the Le Corbusier idea they put little people in the drawers and slid them in. It seemed obvious to us, therefore, that there had to be sufficient flexibility, and an approach to land use such that perhaps at least for poorer families, you respected the fact that when you put too many of them together, you begin to break down social order.

We found, for instance, in doing some very simple social studies that when you began to put four to five people onto a corridor, people would wash the corridor; but if you put eight to ten people onto the same corridor, you could rape a woman in the corridor and nobody would come out.

We further found, and this is something that I took from John Turner's studies of Barios in Peru, but which relates to what is going on in the United States-- people's first requirement is location in terms of a priority; their second requirement is home ownership; and their third is a modern house. What is interesting is that people living in the public housing are now beginning to demand a say in how the houses are run. And the intriguing thing is that the major problem of the riots in Detroit were people taking television sets and things to make their houses modern. And it occurred predominantly in an area where there was home ownership.

So it begins to say that when one solves the housing problem, one must solve it in a dynamic rather than a static way; and that the technology although not important must be considered in a changeable pattern, because the requirements will change. There is a tremendous puch now to determine user needs, and the question is, user needs at what point? Believe me, if we design user needs in terms of what a black family wants right now, it's damn little, but what it wants five years from now may be a heck of a lot different.

So our feeling was that as we began to look at the problem of housing, that there was a need for a major re-thinking in the way the technology and the so-called software interfaced.

Now, I'll give you another example, one I took the liberty of using at FHA; and I was told I would never be allowed to speak there again. Because I proposed a very simple thing. A man built one "cell" originally on a piece of land. When he got a little more money he added two cells on and opened up a store. Now, how many of you have designed a government project where they permitted you to put a store on to a man's house?

The first thing they tell you is, "Well, if we are going to finance it, he is going to live the way we do." Of course the store paid off rather handsomely. The fun of this at FHA was that the second story was added on at a later date. It became a short-term hotel with one of the young ladies working in one of the rooms there. [Laughter]. If you look at any ghetto area, any poor area anywhere in the world, you sill find people using a secondary industry as a means for survival. Yet we effectively cut this off in most things we do.

We felt that it was about time that the government stopped controlling the way people thought, and in fact provide dollars for space. What we really need is to provide enough money for people to have a space in which they can do a number of things, all of which will change over time.

But that space should be flexible and we should finance that space.

Well, having done that we took a long look at the way our designs were progressing. The idea of building on a lot so that we could work over an existing urban infrastructure and increase the density by about 30% without changing the water, sewer, or electricity, we figured represented a rather significant savings in terms of what's already in the ground. Yet when we put a high-rise, multi-story building in, it can effectively change the water, sewer and electricity requirements in a particular area. Our idea was to use what was there.

So the question was, "How did you begin to build a building system or a design?" And if you will notice, I moved directly away from the system per se into how you use the system because no system in itself is the answer; it's how you use it.

We started studying things like front steps and we found out that poor people needed front steps. Yet one cat told us that only the poor sat out front-- he had a hibachi out back.

It is kind of fun because when we finished building one project, the woman who lived behind marched through the house and said, "Who's the damn fool that designed that house?" The mayor at the town meeting stuck his finger at me and said, "Everybody knows that poor people can't afford balconies." I pointed out that one of the things that was intriguing about this was that the kids would play of the lower balcony, while she could sit up on the upper balcony and drink coffee. I thought it was terribly important, I said, for her to sit down and drink coffee and hold an intelligent conversation; because everytime I saw her-- she had eight kids-- the kids were climbing all over her. Then she walked out and she touched the first balcony, and when she got to the second balcony she touched it, and she sat down, she leaned over; and she came marching down and she came in and she gave me a big kiss and she said, "It's about time somebody thought about me!" [Laughter].

Well, we lucked out, naturally, and we had a good, quick answer. But the point that I make is that a lot of things people need we haven't begun to identify. It doesn't matter how many new systems we come up with-- if we don't identify those needs, we solve no problems.

We found, for instance, that black women needed large kitchen-dining rooms; yet, the first house that we had to design which some black families were moving into, we found out that the neighborhood representation was basically Italian. Italian requirements were that we put a partition between the living room and the dining room because Mamma ran the kitchen and Papa ran the dining room.

Again you start looking at things and you say, "Well, how do you begin to build in flexibility to meet these kinds of needs?"

What about storage? Storage is expensive when you start building buildings. So in a Detroit project the idea was to build closets large enough that they could have storage in the back and clothes hanging in the front; and then label these closets so that FHA would not stop you from building the buildings. But the humorous thing is that when the contractor built the buildings he put the hanging poles in the wrong place. Everybody has problems like this.

We decided one of the things we had to do is to start positioning the environment. Therefore, we designed an environmental system that had the capability of a knockout panel on one side for electrostatic precipitation, a knockout panel on the other side for humidification, and two quick hand-couplings for airconditioning.

It was kind of great because we were taking some people through the Detroit project, and when one guy got all through looking at the house, he proceeded to pick up the vice-president of a well-known U.S. corporation which I can't mention, and proceeded to walk him through. When he came to the heating unit, he opened the door and said, "Look at that, that's our heating unit." The V.P. said, "So what?" and the guy said, "You know, they designed the heating unit the same way I bought my Caddy. With my Caddy I can put in a rear speaker with power antenna later; and here he says I can change this heating unit to have one just like yours if I put the money into it."

It seems to me that these are the kinds of choices which should be open to poor families. But as we began to study what poor families needed, we found that the traditional techniques of questionnaires and so-called sophisticated observations provided us with the wrong answers. Thus we developed a gaming technique which permitted people to participate in structuring the trade-offs they would make in terms of their environments.

We gave the people doll house furniture-- and it's kind of great, the women always started with the kitchen and the men always started with the bedroom. [Laughter]. They started working on what kinds of rooms; how big were the rooms; what did they need; how would they begin to organize their room; where would their bed go?

We found out that we could get people to focus on the thing rather than on us. As a result the information that we started to generate was a much richer, although unstructured, form of information than the traditional questionnaire. What we began to get back was some understanding as to the types of things that people were willing to trade up or down for.

One meeting like this was held in front of an FHA gentleman. We put in a frame so that we could begin to structure the walls, and one guy came in and lifted all the walls out and put his bed in one corner. I said, "What are you doing?" He said, "Well, in my house I want a big bar and I'm going to put my bed over here in the corner." The FHA guy standing next to me said, "Get rid of him, we don't want him." [Laughter].

It says something, doesn't it?

In the model was a little wooden bed with a mattress on it. The next guy came in and he took the mattress off the bed and said, "I like to sleep with the mattress on the floor." Again the FHA guy looked at me and said, "Get rid of him, we don't want hippies." [Laughter].

It begins to say that we are again beginning to structure who gets the housing rather than what do we give them? It points out a very important fact that housing is a very effective political instrument for controlling people and that politicians are using it that way very, very effectively. As we begin to face the primary users of the buildings that we are building, the requirements for the buildings begin to change drastically. As they change you bring on yourself the wrath of hell from the people that control the primary distribution of the dollars, because you are coming up with the answers that they don't want to hear.

In the second phase we started working at another scale. We were trying to find out what were the things that we could vary to begin to have an industrialized system and still have the flexibility in grouping that would permit us to have a reasonable environment. I brought one woman in to play this game. She walked up and came through the door and she said, Okay, Fatty, what do you want me to do?" [Laughter].

I pointed out that each block was a house, and that I wanted her ideal house. So she walked over, pointed to one down in the middle with green grass all around it and a little picket fence, just like life, and she got up, put on her coat, and she said, "Okay, Fatty, take me home. You've got it." [Laughter].

It's amazing. As she was going out I looked at her and said, "By the way, Doris, tell the two people living with you that they've got to move out." She stopped dead. She said, "Why?" I said, "We are going to take the house down that's there and we are going to build that one house with the little picket fence, just as you want it." And she said, "I ain't moving nobody out." "But," I said, "you already did." She said, "But, you know, I'm just like everybody else, if I move them out. They stay." I said, "If they stay, you'll have less than what you want and you'll be bitching for the next ten years. They go." She put the two blocks on and she

looked at me and said, "I'm sorry, let's talk."

Four hours later she started talking about how you varied the porch to control the land; and if you had a passageway, where you had to put lights so that people would control them; where you had to put balconies; where you had to put parking lots where people could park their cars so that the engines wouldn't be stolen. We began to find out that there was a whole secondary culture that we hadn't even begun to understand. We really don't know what it is to live with eight kids, no husband, on welfare.

Until we do understand, it's pretty hard to design a unit.

The key to any industrialized system is to begin to put it together in the larger fabric of the community.

We carried the game all the way through and we began to have some ideas as to how to go about designing units, not specifically the hardware that we had developed, but in some respects a justification of some of the hardware. We did an economic study and we found out, for instance, that most of the repair and maintenance was on walls and mechanical systems. It began to suggest investments in structure on a cost-benefit basis. If only we could get the government to talk cost-benefit-- I had a huge argument with one assistant secretary and I politely told him, "Damn it all, a horse is still cheaper than a 747, but when you want to go to London, a horse is a damn bad choice." [Laughter]. It's about time that we started looking at housing in this same context; not the initial cost, but in terms of long-term costs.

We started to look at component obsolescence. Could we begin to define what parts of the house wear out at what rates? Could we begin to determine when these rates indicated an overall deterioration of the unit? All of these emanate from the fact that if you have a system that you can bolt together, if you can unbolt the parts that wear out, you have a potential of prolonging its effective life.

If we drove an automobile and had to throw it away when the tires wore out, we would say it was a stupid design. But have you ever tried to take a window out of a house; have you ever tried to take anything out of a house for replacement?

We studied depreciation rates. That's where you always run into problems because you then start talking with the bankers and they really don't want to shut off a good thing. They are the only ones who guarantee their interest rates, guarantee that they don't lose. Just try to come in with a new idea and get financed; try to come in with anything other than the standard that Grandpa did, and you are dead.

It's like the fellow who was giving a lecture in an old Scottish university. About three-quarters of the way through the talk he looked down at the fellow in front and said, "How come you are not taking notes?" The fellow looked up and said, "I needn't, sir, I have my father's." [Laughter]. Concerning those things related to the financing of housing, they are Great Grandfather's notes. Father's notes are an innovation. [Laughter].

We were audacious enough to propose multi-phase financing. The gentleman in FHA that I proposed this to lost his job something like three months afterwards-- and I rather expect why. But again it is kind of interesting. We tried to build in upstate Vermont and we found that there was plenty of wood. We recommended wood-burning stoves. But don't ever try to do this, because our government says that if you build housing for people they have to have standard American housing. You see, the wood-burning stove is only for the poor. So, although people were almost outside in tents, you couldn't give them a decent house with a wood-burning stove because that was below the standard. Yet they couldn't afford gas. They could go out in the fields and pick up wood. Something tells me that's pretty stupid.

It is about time that we started looking at the houses as a series of parts that get financed in a different way. That begins to suggest alternatives. We thought we were kind of bright, and we attempted to initiate some new technology because the government at the time we were talking to them, thought that the biggest answer to all problems was hardware. So we developed a knee joint which we then put through a large number of tests.

We started using a lightweight concrete column which we put through a large number of tests. We went through a rather extensive testing program on the beams and slabs. We presented out results to some people who ought to know and they reviewed it and shook their heads and said, "Well, the man's a killer. These things are bound to fall down." It finally went to Washington and there was a senator involved. In one of the meetings one of the fellows stood up and he pointed out that he was a university professor and came from a foreign country and that he was head of the precast industry in that country. All the time that he had been head of that precast industry he had never seen a framing system or a joint anything like this before, and he thought it was kind of crazy. One assistant secretary said, "Thank God, Mr. Senator, at least we are financing something different." But the net result was that when the final committee reviewed it, they said it might stand up and it might fall down, but it was worth a full-scale test.

The thing was built at the Bureau of Standards and was supposed to carry 40 pounds in a bathroom-- 40 pounds is the standard load that we design a house for. Forty pounds in a bathroom is four people in a tub, three people sitting on the pot, five people washing their hands, and six people waiting for an opening somewhere. [Laughter].

We indicated that we did not think that this was the way people really lived, and that maybe it was time to re-think the loads. We were politely told that the standards of loading date from some reports between 1900 and 1915 and that the health reports governing our housing date from a Public Health Service report in 1921, and that the standards for public housing in the United States were set by the Congress of the United States, which says that housing should be good enough so that you can't call it a slum, but bad enough so that people won't want to stay there.

That doesn't give you much room for very much. But anyway we built this. I was called up the morning the thing was to be tested. They were going to put a hundred pounds on it and they told me that if it stood up, they had to find an excuse for the building inspector; and if it failed, they would prosecute me for malpractice. I right away decided that the penalty for innovation was too severe-- I don't recommend it to anybody. They put a hundred-pound load on this which was the ultimate working load of the building and kept it for twenty-four hours. They called me up after they took the load off and it recovered 110%, and said, "Something went wrong." I said, "No, we put rubber bands in the concrete." [Laughter].

So then they decided they had to test it to failure. They brought it to a load of 385 pounds. There was a deflection of a half an inch in the main beam; there was some minor cracking in the principal beam, but no serious signs of failure per se. Then there was a tremendous explosion and as one man from the Bureau of Standards said, "It was really funny. Everybody had to duck in the corners." There was a great cloud of dust and when they turned back, the testing frame had failed. [Laughter].

Now, you might think that is a neat deal, to build a building that failed the testing frame, but don't do it, don't do it. We were supposed to carry 40 pounds, the ultimate was about 125; it carried 385. Eight months later I applied for FHA approval of the system and they said, "No, we can't give you approval because it was never carried to failure." [Laughter].

About seven years ago we proposed a particular plumbing system. We proposed a single-vent, thin wall, plastic vent and a vent-drain system for the units that we were building. We made a drastic mistake. We had a huge meeting in which an assistant secretary went to this city. The building inspector was there, and he pointed out that the design of the plumbing was totally incompetent. After four hours of hassling we finally found out that the problem was that there was only one drawing, and there were eighteen buildings. We pointed out that the knuckle for this floor was the same as the knuckle for the second and the third floor and that that knuckly was the same whether you were building a house or an apartment building; all of the units had been designed with a standardized module. We pointed out that this was something called systems building, or at least that's what I thought it was, when you get a repetitive part and therefore you can simplify the manufacture of that one part. The inspector looked at me and said, "I ain't seen nothing like that before. I can't give you the approval on it."

So, eventually we took the drawing out and made eighteen prints and numbered them one through eighteen and got his approval. [Laughter].

We must face that kind of local problem. But you

can't think ill of the local guy. He's the plumbing inspector, he was in the local plumbing union; he got a political appointment to the city. Every city has to have a plumbing inspector so that we don't get into problems. In this case, all of a sudden we were dancing in front of him with new technology, this wall, plastic, single-vent; we were talking hydraulics. This is absolutely terribly difficult.

And then, of course, you have the second thing; you have Big Daddy in the Federal Government walking in saying, "Approve it, we say it's all right." They go back to Washington, and when it fails, the poor guy sitting there in the home town loses his job.

As one guy pointed out to me, "I've been on this job for 14 years and I'm not going to lose it for you." You can't really blame him, can you?

We have got to face up to that problem before we start talking about systems building in this country.

Well, we went one step further with the frame system. We could de-technologize the thing to the point where people with very little skill could build it. This is where you run into another problem because we went out and hired people who couldn't get jobs. In the local Boston area these happed to be Puerto Ricans; they couldn't speak English so they weren't good for the job market. But they functioned beautifully for us. They manufactured all of our parts and we sat back and we thought, "Boy, isn't this great. Here we have pumped a hundred thousand bucks into the local community. We have given a bunch of people who were on welfare, jobs." Then we found out that there were guys in the City who would cut our throats in a minute. We started checking and found out that once these Puerto Ricans got jobs and they started getting money, they also started getting some pride and bought some new clothes. Once with the new clothes, they started showing up at the City meetings and they started deciding that now they were respectable citizens of the City and that they could demand some of the City's services. In fact they were even forming a block of people that represented a political force that threatened the existing status quo.

And as one guy told me, "Look, I don't care what you do, but keep those guys the hell out of here." I think the problem comes out in the fact that you start off with a problem statement that says, "One of the keys of the building industry is that because the technology is low enough you can bring people into it at very low skill levels and, therefore, you can begin to employ people that don't have jobs." The boomerang of that is that once those people get employed, they become political forces.

We designed a system that was set up so that unskilled laborers couldn't make a mistake, that their assembly procedure was nothing but a step-by-step assembly procedure. The erection system was simplified so that two guys could rotate the columns in place-- a very simple erection system so that again we could hire local people.

So, from a systems standpoint, if you say one of the objectives is to give people jobs-- which might be one of the very important needs of a systems-type solution to housing-- then you can simplify and industrialize the process from that point.

If you want to go all the way, you design the system with a very lightweight material so that two guys can lift a column and two guys can lift a beam. But you never show this in the United States like we did, because every union guy wants to shoot you because there's a guy that oils and a guy who runs the crane; and they make far too much money to want you to be able to build buildings with nothing more than two 55-gallon drums. But it begins to suggest that one can simplify the technology for housing and involve people in it.

I think Forrester's book points out that the city is dead as long as you assume that people don't have a soul or a heart. If you can somehow engage people, give them work, find a way to provide a system in which they can participate in the design, participate in the building, that begins to be a part of the solution in itself.

The flexibility of a frame system is such that you can build a single-family house, you can begin to build a duplex, and you can begin to build an apartment. The bones are the same; the flesh, the way you flesh them out is different. The fun of the thing is that you have the flexibility to deal with a variety of elevations, and a variety of materials, a variety of textures. This permits you to localize the design to the particuler community that you are working in.

In a small frame building it permits you to build a building in which the in-fill is almost a cabinetized in-fill that fits between defined limits. This simplifies the in-fill procedure. The important part of the design is that the details become almost a finished detail.

So what we attempted to do was to take a technology and divert dramatically from the more impressive ways. This does not say that the panel solution and the aggregation of markets is not an exciting and a powerful solution. But it does say that there may be a possibility in this rather complex environment of putting people to work.

It may be logical to find a way to build a facility where your cost of start-up is about a hundred thousand dollars and where you can localize and utilize the local man already there to assemble the parts. What it does in not to ask as big a change-around as Mr. Romney has asked, which is, namely, that all the little guys go out of business so that a few big guys can work. What it does say is that you are increasing the capacity of the little guy so that less of them will go under. You are providing them a base by giving them a higher level of technology, without forcing them to pay for it in terms of their own research staffs. You provide an opportunity for a flexibility of design which seems rather attractive from an architectural standpoint.

The key of this obviously is that it is a one- or four-story building. The most important thing to remember, however, is the fact that if you attempt to bring innovation technologically through, you to bring innovation technologically through, you threaten existing structures in terms of the way things get approved.

If you attempt to bring people into the design of their own house, you threaten social norms which say, "It takes eight years to become an architect. What the hell are you doing letting poor people design their houses?"

And if you begin to give people in the community jobs, you begin to raise another force of people who begin to effectively act politically.

Therefore, one of the things that I see is that if we begin to start solving the housing problems, we create a whole new set of problems which are in fact part of the housing problem.

Thank you. [Applause].

THE CLASP EXPERIENCE

J. BLACK, P. de BRANT, S. MEYRICK, H. MORRIS

U.K.

CHAIRMAN DAVIDSON: Now, without any more to-do because we have a lot of real work to do today, I introduce Stanley Meyrick to kick off.

MR. MEYRICK: I am the first of a team of four who are billed on the program to discuss the CLASP experience. CLASP is now nearing its twentieth year and we have an hour in which to discuss it. This means that we are going to have to compress it pretty severely. So, what we do today will be something in the nature of an introduction, and I hope that this afternoon and tomorrow in the seminars we will be able to develop points of particular interest in more detail.

There are many other people, of course, in CLASP, but it happens that we four have been concerned with a particular aspect of it which we think may be interesting to develop here. But first, let me tell you what CLASP is, how it developed, how it became a significant part of the building scene, and something of its history up to now.

Hugh Morris will discuss some aspects of it with emphasis on the architect's role in the system. Professor Joseph Black, one of our valued clients, will discuss it from the user's point of view; finally Peter deBrant will describe in more detail the kind of thing that emerges as architecture.

We have had occasion to talk about this quite a lot in different parts of the world and in conversations here at this conference. We constantly find that there is an idea that system building in the broad sense is a recent phenomenon.

This is not by any means the case. Depending on how you look at it, you could regard system building as a thing that goes back to remote antiquity; or you could think of it as something that began with the Crystal Palace at the Great Exhibition in London in 1851. System building isn't new. Perhaps it is less inaccurate to say that although all building is becoming systematized, what we understand by the term as it is used today is not yet the commonplace.

Before the end of the Second World War, our government, although heavily preoccupied with what many people thought more important matters, decided that it was necessary to set up a committee to consider the possibilities of applying some measure of standardization to overcome the increasing difficulties of the construction industry. They were driven by the realization that the difficulties they were struggling with during the War were not going to melt away when the War was won. They foresaw all too clearly that shortages of traditional building materials and of skilled craft labor would persist for an incalculable time after the War. The suggestions made by this special study group-- and remember this was in the middle of the War-- enabled one education authority to get two very urgently needed schools built before the end of 1946, at a time when you could build practically nothing in Britain.

These schools were achieved because they were built from a set of components. They were in fact the first recognizable component-built buildings in the country. They were successful and the authority was encouraged to apply the same ideas to the eleven schools which completed their school building program for the coming year.

Not by any means the least of the advantages which stemmed from this component idea was the fact that bids could be invited not, as was customary, for eleven separate schools, but for runs of components sufficient to build eleven schools. The consequence was that the sizes of the resulting orders enabled the authority to take advantage of the economics of buying in comparatively large quantities. This was so far as we know the first time this had been done in British building. The traditional procedure is one-off tendering.

In the following year, 1948, the program for the same department was twenty-one schools. They were all built. It is now realized that without this idea, that couldn't have happened in the circumstances that prevailed. Indeed, all over the country it was becoming apparent that there was a gross insufficiency of craft labor, not only for the schools program, but for houses and every other kind of building. Prefabrication-- a word which Mr. Lawrence and others yesterday said would have driven us out of the country-- was seen as a practical solution to the problem.

It is interesting to compare the course of the development in school building and in house building in England. It is fair to say that the school building program succeeded and is now well known, while component-built housing has not had the same order of success. There was a difference in the way the two things were developed. We had a need for housing as urgent as the need for schools in the immediate postwar years, and a great many systems were developed and marketed in response to stimulus from central government. But a standard house plan was prescribed and developers were expected to design systems capable of application to a limited number of variations of that plan. The result was that the planning element in the house system was lacking.

In the school world the situation was entirely different. Educationalists were thinking hard about their methods and as the component idea grew in the minds of the architects, ideas for new ways of teaching were profoundly influencing the planning of schools. This was much more fruitful ground on which to work, and the degree of cooperation between educationalists and architects which grew from it may well be one of the more important reasons why our main advance in industrialization has been through school building.

After this preamble we come to the story of CLASP in particular. CLASP is now a word recognized all over the world, but its origin and meaning are not so widely known.

CLASP began in Nottinghamshire, a county in the middle of England, whose area is almost totally undermined by old coal workings, creating the problem of land subsidence. In the middle of the 1950's this county needed to spend something like 2.5 million dollars a year to keep pace with the need for new schools.

From early in the War until 1955 you couldn't build anything at all in Britain without having a license. When licensing was taken off in 1955, the demands on the industry were enormously increased, but unfortunately, there was no corresponding increase in the supply of craft labor and there was very little in the supply of traditional materials. In fact, they became so scarce that they virtually went off the market.

In Nottinghamshire, the cost of precautions against the possibility of the subsidence was amounting to 10% of the total expenditure of building. The county architect, Sir Donald Gibson, set up a special study group within the architects' department to examine the whole problem of school building in the particular circumstances of time and place. The technicalities of the results of this study and the way the present CLASP system has grown from it will be discussed in more detail later.

I want to draw attention now to one or two ideas which seemed revolutionary at the time, but without which the project could never have started.

One of these developed from the realization that if you shift manufacture from site to factory, you are no longer contracting for a building, you are contracting for the batch supply of components. If this supply is to be even reasonably economical, the batches have got to be large, much larger in fact than those required for any one building. Of course, this is elementary in almost any industry, except the craft-based building industry, in which in the England of the Fifties, it was revolutionary.

Nottinghamshire realized that even an order for 400 tons of fabricated steel work, which they required for one year's school building program for the County, was insufficient to secure the full economic benefits that could be had from the manufacturing capacity available to them. It was this thought as much as any which led them to seek the cooperation of neighboring school building authorities who also had mining subsidence problems. You have to realize that large areas in England suffer from this problem.

By making a combination of authorities, and thus pooling the demand, better use could be made of the resources. From that realization the consortium idea grew; not without a great deal of labor, of course, because there were endless difficulties to be overcome, not the least the imagined threat to the autonomy of elected representatives. You are familiar with these problems, no doubt.

I can now explain how the word CLASP comes about. The consortium which is what the C stands for, is not a consortium of manufacturers or of suppliers or of contractors or even of consultants; the consortium is a consortium of clients. The mystic letters C-L-A-S-P stand for Consortium of Local Authorities Special Program; the special program being the educational program, and the organization is exactly what it says, a consort of local authorities.

Now, these member authorities banded themsleves together to form a comparatively large clientele sharing a need for a particular kind of building. By pooling these needs they created a demand large enough to utilize economically the production potential of the various supply industries. Also by pooling their professional resources, that is, educationalists, architects, engineers and quantity surveyors, they are able to give expression to the demand and ensure that it is met in a way that satisfies their needs.

The day-to-day working of the machinery of the Consortium we can go into later, but I just want to mention how policy is controlled.

Policy which has of course to be coordinated among all the members, is directed by a board which consists of the chief architects of each of the member authorities. That board reports in an annual general meeting to the elected representatives of the member authorities. In this way, the electorate has a say in the way its money is being spent.

The hard work-- the "coal-face" work-- is done by a development group, and although the term has become universally used, it originated with CLASP. The development group consists of architects, engineers, and educationalists, from the staffs of the member authorities and controlled by a working party which is responsible for the organization of the pooled program.

That brings us to the program. Without a forward program to which every one of the members must be firmly committed, the thing couldn't get off the ground. The one essential ingredient of the CLASP consortium is a commitment on the part of the members to a forward program of building.

The CLASP program setup began annually in 1957 with fourteen projects. The total value was not quite two and one-half million dollars. With occasional setbacks which reflect anxious moments in the national economy, it has grown to nearly 200 projects this year and the total investment will be of the order of 60 million dollars.

Now, this growth reflects other things besides anxieties in the national economy. It reflects the success in the first place of the method of working. Mr. Lawrence quoted Oscar Wilde yesterday. I'm going to beg leave to quote him, too. In "Lady Windemere's Fan", he has a nice little phrase, "Nothing succeeds like excess", and that is true of CLASP.

Membership has grown from the original seven who were all local authorities with school building programs to this year's total of twenty. The twenty members include three universities, three government departments, the University Grants Committee which I represent here today, and a regional hospital board. In addition to twenty full members, there are twenty-three associate members.

Most of these are authorities with large building programs. Others who want to use the system, although their own programs may not be large enough to justify full membership of the consortium, can do so through the agency of members. My own University Grants Committee is an agent for those universities which do not have programs big enough to latch on to CLASP.

This growth and the diversion of the membership has necessarily extended the area of application of the system which was developed originally for schools.

Development work is a continuing feature of the Consortium's activity and we will hear a bit more about that later. It is supported by a levy of one-quarter per cent of the value of each member's annual building program. Each successive Mark of the system, or the phases through which it goes, has extended its scope. Mark IV, which is now just coming to its end has been used with great success-- as Hugh Morris and Peter deBrant will tell us in a minute-- for the residential colleges of the University of York. The University of York was the first university to join the Consortium as a full member.

From residential colleges it seemed a logical step to investigate the feasibility of applying it to other kinds of university buildings, with their rather more specialized problems of loading and services. So, we set up a thing which we called the Joint Development Project-- and that has given rise to another set of initials: CLASP/JDP. It is the JDP growth point of CLASP that we want to discuss in more detail now. Just before we go on to this, I will add that as a growth point it is growing at the moment, and will become CLASP Mark V. It is on the drawing boards now.

Well, this is the moment for me to hand over to Hugh and I must apologize because I have run over my time by about five minutes.

MR. MORRIS: I hope you will forgive a bit of repetition. We thought quite a few people would not make it at nine o'clock this morning. I don't know what you did last night, but I needed the rest. Also, I'm going to have to rev up and cut down a bit to keep the time.

In talking about British architects' experiences of systems building for education we tried to compress generalizations from ten years of doing it and maybe twice as long thinking about it, into fifteen minutes. Each of us brings his own bias arising from the context of his own personal experience to the subject.

We knew before we came that the conference was bound to be bedeviled by the differences of definitions, or more accurately, preconceptions of defi- what systems building means as indicated on this dais because it means so many things to so many people and some of them have not much to do with one another.

Its images, as we are seeing, include the Meccano set, the precast concrete cardhouse, the computer buzzing away, and systems of thought and management for integrating the design, production, assembly, and maintenance of buildings, to name but four.

To place myself or confess myself, my own bias image and experience tends towards the Meccano set; towards, if you like, Medieval Japanese, the theme of flexibility, light, dry, adaptable, capable of responding easily to growth and change, reducing the conflicts between the permanence of buildings and the transience of patterns of use; a hardware preconception in a sense, but with an attitude in the line of or philosophy of that which Neal Mitchell put to us yesterday afternoon.

In 1950 the lead in system building in Britain had been taken or given by the Hertfordshire County building program; and this is where many of us started from. If one could visit as a student, one went there, and saw incredible contrast, absolutely immediate and obvious, between the schools and the houses.

The houses were traditionally built brick boxes by the thousands and as first priority they consumed all the available craft skilled labor force-- brick laborers, plasterers, carpenters. The educational building program was the second priority, having to build in these fertile breeding grounds where all the young immigrants were breeding away like mad after the War, and having to aim at maximum economy in the use of the craft skilled-type labor, not the cheapest. The schools sat amongst the houses looking like things from outer space. They were a real breakthrough. They were the product of simultaneous innovations, I believe, in administrative procedures and in technical development.

They were both a manifestation of those innovations and they were an inspiration to a new generation of architects. Now, twenty years later, the educational buildings are still in front of the systems building in Britain. Economy of site labor is still its first aim and the tripod of simultaneous innovation in the brief, the administrative procedures and the technical means of solutions is still its base and strength.

Sidetracking for a moment-- and it's the same sidetrack that my colleagues have taken-- in the early Fifties several Hertfordshire-trained architects and newly qualified colleagues moved into the London County Council's housing division

hoping and intending to apply the lessons of the school building, systems building approach to housing.

They achieved quite a lot and a lot has been seen very conspicuously all over the place. However, one thing they didn't achieve is what they set out to do. And I hope the conference may at some stage further explore the reason for that, and it may be an experience from which a lot can be learned. I am not going to give my own explanation of it. You have one from Stanley Meyrick and George Lawrence, and there isn't time, but it is a fact that now half of our total annual primary and secondary school building is system-built by the Authority Consortia. In contrast, Britain is dotted with big contractors' plants for prefabricated, precast concrete housing which are hardly used, and with a crop of tower and slab housing blocks which are, by and large, a sick headache to their owners, their users, and their architects; and the target, of course, for a justifiable stream of abuse from the sociologists who are very wise after the event.

While this industrialized building effort in housing in Britain in the Sixties rose and fell very noisily, the school building systems in the hands of local Authority Consortia just went on growing fairly quietly.

Within our present total 160-million-pound school building program, about half is built by Consortia and that I think is $200 million a year. CLASP is the largest of those, now in its fourteenth year with an annual program of about $65 million with a wide range of buildings other than schools.

Behind that quiet and steady growth there are a whole string of factors, but I will pick out one or two key ones; and here is the repetition.

The first is that the Consortia are pooling their needs to establish their programs and are owned and run by organizations representing the users of the buildings, not organizations of manufacturers, contractors, or designers.
Though Consortia are welcomed by central government and given some encouragement, they were formed on local government initiative. What they are doing has not been done, I think should not be done, perhaps could not be done by central government whose role as we see it is to secure and commit the capital to them and give them liberal scope to get on with the job in their own way, within minimum standards and maximum costs, with a decent gap between the two. Therefore, the Consortia are run by working parties or monthly management meetings of local Authority employees, who are almost entirely socially oriented. That is to say, their primary interest is in what their buildings do for the users, how they do it technically. How they do it aesthetically is a secondary matter. In other words, they share a deep interest and a fairly sound knowledge of the uses of their building and collaborate continually in the educational field with education officers, with teachers, and with children in a curious and interesting way; and with their colleagues also employed by the local Authorities.

The architect's role in these Consortia is crucial. I don't think Consortia would have come into being except on the initiative and suggestion of architects working in conjunction with county clerks and county treasurers, and through them with county councillors who keep changing. The Consortia have got these architects and they have taken the chance to narrow the gap between the manufacturer, the designer, and the user.

The strength of their work and the economy of their schools lie not so much in the size of their programs as in their continuity. They are able to marry up the largest appropriate industrial firms to quite small programs of mostly quite small and scattered buildings.

I don't think that building systems are movable from country to country, but this vital continuity is the key word. A small continuous program is preferable for the industrialist probably anwhere to a great big uncertain one.

We could consider the fate of some notorious non-starters in Britain's postwar system building-- the aluminum house, and the Ibis project of Richard Thomas Baldwin. What the local authorities have got which the other agencies haven't got is simply the assured, foreseeable, committed, rolling program. It doesn't at all have to be big, it just has to be fairly sure and keep on rolling, and it can be created. You don't have to sit around waiting for it.

It is the continuity that gives these architects their role and their chance to develop technically flexible and evolving solutions, through monitoring their own work and getting feedback and using it to get the best out of it, and in a sense to control industry through the bulk purchasing situation, as well as to speed and to rationalize design-- and use the time saved not necessarily to do the next one but to focus more attention on studying and meeting changing user needs and to control and to plan costs; and if there is money saved, to build more schools or better schools or the better furnished schools, or better land; and to establish through serial tendering the close relationships; and learning the solid development work at quite a small cost. It is a quarter per cent levy on the total of the contract to support the development group, and through that increase their own competence and certainty.

These are only some of the ways in which continuity, which is one word we would most like to leave in the minds of all the players in the process, helps us to develop and extend the role of the architect and I would regard that as a fact.

I think that there are a lot of people who would stop there and call it a contentious opinion or even maybe a political argument, which it isn't. There are, of course, many architects in the UK who see the growth of systems as restricting, not extending, their role and scope; and maybe there are some here who feel that way.

I think those fears are really important, since the architect's voice is very often and quite properly and powerfully the first voice in the detailed debate, and the first one the commissioning client will listen to. In Britain these fears and resentments have been and still are a major check or impediment on the development of the system building.

The fears are often bred in schools of architecture, rooted in simply the limiting experience and the natural bias of staff drawn mostly from small-scale, private practice. We can't allay those fears by making speeches and we can only cope with them as it were through the evident qualities of the product, the buildings, for those people as architects.

It is naturally the product, not the process, which counts in the end and maybe we should be a little wary of the conference slogan, "The Process, Not the Product", because of its implication of an emphasis and interest in means rather than ends.

For the users also it is the product which counts over a long period and by which we are all judged, "By their fruits shall ye know them," as somebody put it a couple of thousand years ago. [Laughter].

If we don't have the conviction that we cannot only deliver better value for money and buildings faster with better use, but that the products are going to be in every way as enjoyable to look at as well as to live in as the best traditional buildings and very much more adaptable to the growth and change, we should all stop talking and go home, back to the handmaiden of the craft-based industry, a harmless, very pointless activity.

We have enough experience now to know, I think, and to show that we can build excellent, indifferent, and rotten buildings using systems just as we can with bricks and mortar. The quality of the product depends not so much on the process itself, but on the quality of the mind and the values of the suppliers which arise from and reflect through the kind of society we live in. There is another architect's attitude which can damage our work as much as any fears or suspicions can hold it up, and that is naive enthusiasm for systems building. Wild and hasty and arrogant claims are being made for it by architects, losing sight of their clients and the places to landscape and the climate, in an effort to rationalize and systematize the design process and delivery process; and doing so in the name of technological process, computerization, or what have you.

That attitude is a menace. Not a very large one yet, as it happens that most of them who hold it are on the whole ineffectual in getting built products out of it. So, I will leave it.

The one last rather particular point of it is the universal building application to the urban development, for instance, the kind of thing that David Crane was showing us yesterday. I think we need to have a fair idea of the nature of the building methods we intend to use at the initial stage of preparing the development plan for any large complex or campus or building. That is difficult.

We need to know roughly what three-dimensional disciplines these methods imply, and also have a

good idea of the fourth dimension-- time-- and the strategic costs plan, since those are all essential factors in development planning.

Therefore, the initial development planning team should include the executive architect who will follow through, or at least an architect who can actually represent them, together with the construction costs consultants and structural and service engineers. We have been on the whole fortunate in this in England at York and Bath and elsewhere. The higher the density of the complex, the tighter the mix of land uses and building types, the more vital this becomes. The practice, therefore, of commissioning overall planning consultants or management or space-use consultants to work for months or maybe years before any architects are brought in-- in sometimes almost total ignorance of the building implication-- for their strategic development plans is a recipe for disaster.

The kind of two-year difficulty that David Crane got into is only one of those sorts of problems. If it is not a disaster, it is at least a horrid mistake, the wastage of time and effort and ultimately it may be visual chaos.

So, on that last warning note I will hand over the platform to Professor Joseph Black who will talk as a user/client of a university.

PROFESSOR BLACK: It is with some trepidation that as a layman, a mere client, that I stand up in front of a distinguished audience of architects, administrators, government agents, and with my flanks exposed to my friends, the architects of my own building. I use the term "friends" in its narrow sense-- if you have architects for friends you don't need any enemies.

I expect what you want to hear from me is, first, how come responsible people, generally considered to be of sound judgement in their own sphere of activity, should throw caution to the winds, and gamble their hard-earned, or at least hardly-extracted public money for a university building project, on a crack-pot proposal to erect a large, heavily-utilized building from a few factory-made components? Then, having accepted, how was the specification affected? Next, how did the design evolve, and finally, what has happened since commissioning?

1. Acceptance of a Systems Building

Our particular circumstances were that we had to move a well-established college of science and technology in Bristol to a brand new site 15 miles away in Bath. We wanted to establish a bridgehead quickly, both to start new subjects and give an administrative base. The standard CLASP school building was the right size, and the specification was acceptable. York University had also successfully used CLASP for its main buildings. It was available on time and on cost, and though there were, and still are defects, it met our needs admirably. Here it is now some six years old; our School of Architecture will be moving into it is a year's time when the remainder of Biological Sciences moves to a new building.

Because of this success we were ready to consider an extension of the system if its use would allow the large School of Engineering to move on a very tight time schedule. There was also a possibility that because it was an experimental project funding might be a little more generous-- a naive view, that just proves what nice innocent people we were then!

As a technological university, and as engineers, I think we also felt that innovation should be the central theme of all our activities-- what better way to reflect this belief than to live and work in an innovative building.

2. The Specification

We were not prepared to relax our demands on essential features, however. High priority was flexibility, heavy servicing throughout, and structural stiffness. We knew from our CLASP building, that the upper floor while acceptable for offices and chemical-type laboratories, would not be stiff enough for technological laboratories and we did not wish to have our functional use of the building dictated through being restricted to ground-floor. Thus we would only accept a system heavier than CLASP, which would give upper floors as good as those of the best conventional structures.

In the heavy ground-floor laboratories we demanded adequate height, and plenty of wall area-- not necessarily load-bearing, but to form solid envelopes.

We required an extensive distribution of electricity, gas and compressed air services throughout. But we knew that even with all the foresight we could muster, there would be operational changes, and new developments which would need new access; for example, closed circuit television without the necessity at the planning stage of predicting where every monitor would be, hence all the ducting required.

3. Design

There were no problems in deciding on the form and functional relationships of the building. We only began to encounter problems when for economic reasons the system became what I called a "Henry Ford" one-- we could have any beam size we liked so long as it was three feet deep. This meant, for example, that on one floor we had to give way and accept a 9 foot ceiling height in a 70 foot long laboratory, when we considered a minimum of 10 feet made it a more acceptable room.

Then as design progressed we would find at quite late stages of decision-making ominous little hatched lines in the middle of our desired open spaces. These were the structural bracing members needed for stiffness. While it may be an advantage to an engineering instructor to be able to demonstrate the theory of lack of stiffness with pin-jointed members merely by leaning against the wall, it is embarassing if the whole building deflects in a light breeze. We grudgingly accepted the braces.

However the architects had a brilliant solution: they could enclose these braces in a wall! So the mistake was really the client's in the first place for thinking he wanted a big open space. All that was then required was a little psychological treatment and brain-washing to convince me that big open spaces can be frightening places, and smaller rooms are easier to manage and so on. We accepted some walls, but we also preferred to keep the braces open in others.

One tremendous advantage the system did give us was the ease of distributing main service runs within the beams.

The only confrontation came over a proposal to extend the system concept to include fitted furniture. We had only accepted the proposition of a system component building which would give us a conventional envelope in which to carry on operations which we believed we were expert in, whether it was a lecture, a seminar, a laboratory class or research.

Excited by the "system" developments some of its supporters ventured further into the concept of system furniture. Some of this was designed on the basis of short period observations of the clients "at play". But the studies were superficial, and ignored for example the superiority of wood supports over metal for experimental apparatus, because of the much better damping properties.

We therefore refused to accept the system furniture proposals, which promised neither comparable performance, reduced initial cost, maintenance cost, or availability over conventional but custom-designed furniture. The architects' furniture designer took our specification and evolved an economical and very acceptable scheme, based on a drawer unit, a cupboard unit, and a carcase. The moral here is that while a client may accept a system building, he is likely to be reluctant to accept a total package "deal", which dictates to him how the building must be used, and imposes on him features about which he is more expert than the designer.

4. Occupation and Commissioning

In spite of the simultaneous development of details of the system, and erection of the building, the building came along on time. We moved the whole School of Engineering in just under three weeks of a Christmas vacation, and started the Spring Term with nearly 300 students in one half of the building, while the other half was completed, and handed over in April.

Undoubtedly this rapid occupation was facilitated by being able to move into a "dry" building. Connecting-up of apparatus and machines was very fast because of the accessibility of services in the ceilings, reached merely by lifting up ceiling tiles.

There have been no major defects: most of those which have arisen are not peculiar to a systems building. One which is, however, is the vulnerability of the glass panels, particularly adjoining door-ways, and a lack of support for doorways

which are located in curtain-walling not close to an upright member.

With noise transmission the dividing wall panels are satisfactory, but considerable transmission can occur along the external wall members, particularly through the inevitable gap between internal and external walls. Floor stiffness and vertical noise transmission is satisfactory. Staircases are acceptable once you get used to the springiness when a class dashes up or down them.

One new aspect of systems building affects the relationship between client and architect. Because much of the detail design is not the responsibility of the architect we have a "Catch-22" situation. Suppose the roof leaks; the contractor as always blames the architect, but now the "architect can pass it on to the System". Have you ever tried suing a system, or even phoning it up to demand some action? [Laughter].

I would suggest that our deliberations in this conference should include some discussions of the new ethical and contractural problem.

I would like to finish by saying that in spite of some of the harsh things I have said, we are happy with our building; it is a good working environment, and it meets our demanding purposes well.

I am not competent to assert that we could not have achieved a similar situation, time and money-wise, without using a system. But I can certainly say that as I looked out of my window at a conventional concrete bedroom block struggling along, months behind schedule, slowing even more as winter conditions hit it in its unroofed state, I remembered the progress of our building, with its roof on within weeks, and internal works proceeding under cover long before any walls appeared.

Finally I would like to quote from Edmund Burke what might be a relevant comment on system building:

"Those who would carry on great public schemes must be proof against the most fatiguing delays, the most mortifying disappointments, the most shocking insults, and worst of all, the presumptuous judgement of the ignorant upon their designs".

MR. deBRANT: With a client like that, who needs an architect? [Laughter]. I had prepared some notes to speak from, but most of what I proposed to say has already been said.

There are, however, just a few words I would like to say, formal words which I have here, and they are in the form of repetition.

I believe the system approach if it is to be successful must be user-oriented and -based; the user must hold the balance between economics and function. The possibility of a system becoming simply a package deal in the hands of a contractor is always present. Once this happens, the number of components and alternatives may be restricted and feedback and development terminated.

The danger is that a building system in the wrong hands could degenerate from the subtle disciplines which guide the use of a variety of industrialized components and allow sympathetic adaptation to local conditions into the production of a standard package design imposed regardless of users' requirements.

In the UK, the CLASP/JDP system is a fine example of cooperation, in this case, between the local county authorities and universities. They offer by their support a large annual program, already mentioned, in the order of $60 million a year; and they also offer continuity, both of which are essential for serious development and feedback within the system.

Finally I believe that system building or industrialized building is particularly relevant to educational institutions. Schools of study come and grow large, and then lose support. Even Professor Black's may! The methods of the study continually change and so with these changes the spaces needed to contain them must also change. The new buildings need to be flexible, they need to have easily movable components. We cannot afford today to build buildings as monuments to a passing study, the transient demands of which remain enshrined forever in the inconvenience of the building.-- That's my formal comment.

Now, for spontaneity, I have quite a large number of slides to show you; and today I intend to deal really with our attempts over the last seven or eight years within my office, and with the help of architects in the United Kingdom to develop CLASP into a heavy system for mainly educational buildings and universities, the Joint Development Project.

A friend of mine, a professional musician, was explaining to me the other day the development of the oboe. He said the oboe had evolved from an extremely simple wind instrument. It had only one hole and consequently gave only one note, a very beautiful note. But if you want to evolve from that simple instrument to a complicated thing like an oboe, you have to introduce more holes and you have to introduce them in the right place. And you also have to learn how to play them after you put them in the right place. Otherwise, you get a very nasty squawk. The pictures I am going to show you are our attempts to evolve from a simple instrument, not as simple perhaps as the example; a CLASP system for schools into a heavier and more complicated system, a CLASP/JDP, a system for universities.

I will show you pictures mainly of York and Bath Universities, which we have had to do with. I would very much like to discuss the methods by which we arrived at the development plans and realized the buildings, but I don't think that that really is relevant to our discussions today. We could possibly discuss it at another time.

(Fig. 1) This is an aerial photograph of York University in about 1965-1966, we have here the beginning of two colleges which are actually in the CLASP system with very minor adaptations to make the bearable for residential use; mainly better acoustical insulation has been provided. Otherwise they are unchanged.

We realized at York that since the CLASP system had not been evolved further than for use in schools we couldn't really build successful laboratories and libraries in the system. Consequently we provided a matrix for a university with CLASP used in the colleges and standard rationalized building systems for the library and laboratory buildings.

(Fig. 2) This is York University in 1971 with a number of the colleges built still in the CLASP system; and the central hall, library, school, laboratory buildings, biology buildings, all in rationalized traditional systems.

In approaching Bath, the proposition was to build a university in the new, heavy CLASP or developed CLASP system/JDP. However, in order to move out of the older buildings in Bristol and get the site as soon as possible, we had to put a building on the site immediately.

We wanted to do it as quickly as possible we conceived and designed a multi-purpose laboratory and restaurant and library building in the standard CLASP system which could be readily adaptable and whose use could be easily changed at any time.

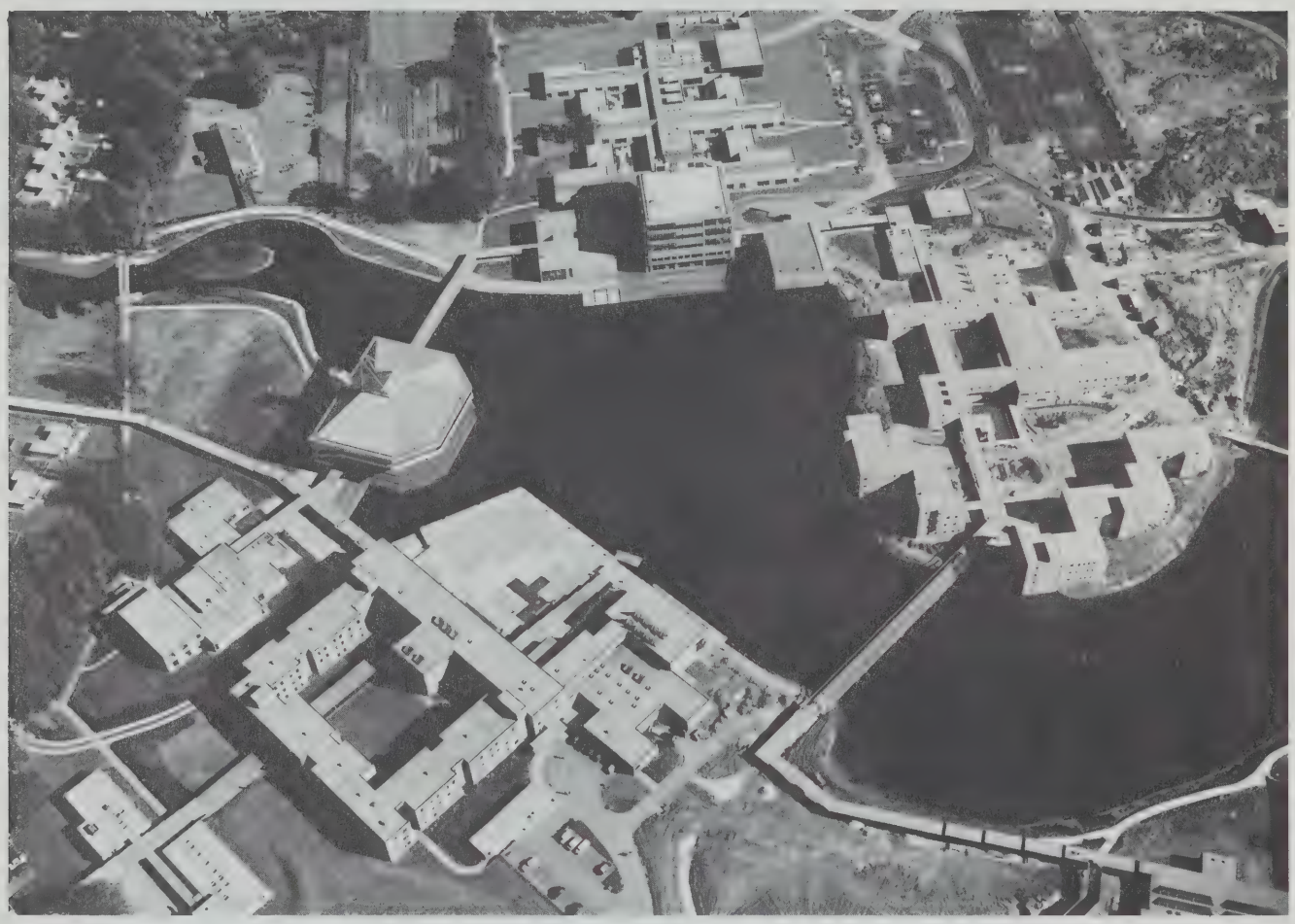
This building acted as a resevoir for the new University of Bath moving over from Bristol onto the new site,and its function appeared to change significantly every six months.

The design of the CLASP/JDP system went on through a period of about twelve months, and was the result of a very exhaustive user-needs study throughout the UK. The system that evolved and has actually been built consists of a heavier steel fram with precast concrete flooring units, and the existing CLASP roof system on the top floor, unchanged, of timber.

The services have always been a problem, actually, in integrating them with a complex system like CLASP; attempts were made to do this-- to rationalize it in JDP and separate them as a package from the structure. In realization actually at Bath, we didn't find it really very useful because in order to achieve these complicated, fine-looking free ways and sections, it involved doubling up the vertical structures; so that at Bath we have actually used the ceiling spaces only, which is really very much a freer way of dealing with it.

All systems before they are started ought to have a mock-up or model. Mock-ups aren't very expensive, and they solve a lot of problems, if not all of them before you start building. JDP's group had a structure for studying how their drawings would work, for studying erection procedures, and also for seeing whether they are realistic. Some adaptation of the system had to be made when the mock-up had been studied, and all these elements appear in the finished buildings.

Fig. 1



We have now gone from the CLASP system, which is a steel structure with timber floors and timber roofs, to the CLASP/JDP system which has a concrete membrane floor and a very much heavier steel system.

Before we could use the finished design of CLASP/JDP, the University, of course, had started to move on site, and while this system was being developed we were proceeding with the building of the University with a very simple rationalized steel roof and steel structure, concrete-clad system using a large number of the CLASP components. It wasn't until the second phase of the building of the University that we really were able to start with JDP.

I should say here that Bath University is conceived in a very different manner from that of York University, which you could see was actually based on a form of collegiate system. At Bath, the University is a very urban concept with residential buildings conceived as overriding a central parade which is divided vertically into two levels, leaving service and cars below, and a pedestrian level above.

Bath University is school-of-study-based which is opposed to York which is college-based, or residential unit-based.

The engineering building is the first CLASP/JDP building; as is the central library, which is the latest CLASP/JDP system building with concrete external cladding.

Of course where the requirements permit, regular CLASP components are used as in CLASP schools--such as interior corridors.

[A series of photographs follows, all taken by Duncan Wilson in February 1971].

CLASP - YORK UNIVERSITY
LIST OF ILLUSTRATIONS

SLIDE NO.	DESCRIPTION
	NON-SYSTEMS BUILDINGS
1	Library
2	Central Hall
3	Physics laboratories
4	Biology laboratories
	SYSTEMS BUILDINGS
5	General view: Goodrich College, left; bridge to Vanbrugh dining hall
6	Close-up; biology labs with clock tower in rear
7	Goodrich College
8	Vanbrugh dining hall; biology labs with clock tower, center rear
9	Vanbrugh College; (York water tower on hill in rear)
10	Alcuin College
11	" "
12	Goodrich College
13	Langwith College
14	Derwent College dining hall
15	Language Laboratories; circulation
16	Circulation; Language Laboratories

CLASP/JDP - BATH UNIVERSITY
LIST OF ILLUSTRATIONS

SLIDE NO.	DESCRIPTION
17	General view
18	Non-systems student residential block
19	Pedestrian plaza with Library on left, Second Engineering building on right; student residential block at rear
20	Plaze with Chemistry building on left and bridge to Math building beyond Library
21	Math building and Library
22	The Library
23	Dining, General Meeting building; vehicular circulation occurs beneath pedestrian plaza
24	Facade detail of Second Engineering building
25	Pre-cast concrete stair detail
26	Wind-bracing detail
27	Laboratory

Fig. 2

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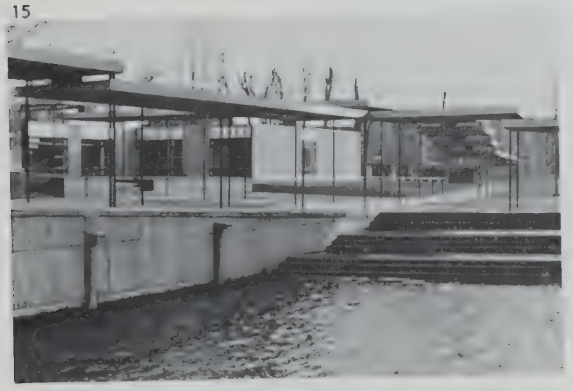

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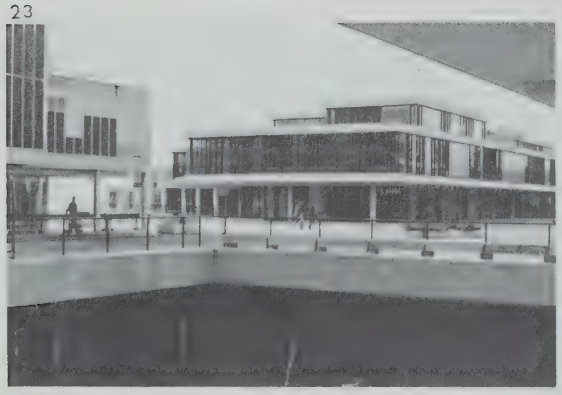

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THE SURGE BUILDING/STONY BROOK CAMPUS EXPERIENCE

F. MATZKE, P. J. MEATHE, R. RUCKTERSTUHL

U.S.A.

MR. MATZKE: We are actually starting close to the time we are due to finish up, so I might just ask if you have any questions? [Laughter].

After listening to Neal Mitchell yesterday afternoon, I almost hesitate to acknowledge the fact that I am a government official. Before we start I might tell you a little about the State University Construction Fund, because I think you have to understand something about us to understand this presentation.

The State University Construction Fund is a public benefit corporation created by an act of the NYS Legislature in 1962. It has the responsibility for the management of the design and construction of all State University facilities in the State of New York. This includes 30 of the campuses of the State University. There are an additional 40 campuses under a community college program in New York State for which we have no responsibility.

One of the things we initiated very early in our working with the University was to develop processes which would rationalize the design and construction of facilities.

We assumed responsibility for a program being handled by the State Department of Public Works which up to that time had been designing and constructing all of the facilities for all the various departments in New York State. Their approach was to do this with in-house architects. Where they couldn't, they would commission architects to simply serve as consultants to the Department for the design of the facilities, and manage the construction of the facilities themselves.

When the State University Construction Fund came into being we decided to utilize the full resources of the design professionals, not only to design the facilities, but to supervise the construction, and give them as much responsibility as we could.

Over the years we have been following a process which involves the architect in all aspects of the program, starting from a program review phase and continuing through the completion of construction.

Since 1962 we have completed the design and construction of over a billion dollars in facilities for the State University of New York, and presently have under construction about 600 million in construction contracts. At the present time we have assigned to architects something close to 600 million in design contracts. Our biggest year was fiscal year 1970-71 when we awarded over 400 million dollars in construction contracts.

Since that time we have reached our bonding limitation. The funding of the State University programs is provided through tuition money which goes into an income fund used to amortize bonds which we sell to repay the State moneys that the State initially loaned us to get design and construction underway on the facilities.

This income fund has increased over the years as we provided more space for students, created more income, and therefore, were able to design and build more facilities.

However, the income fund has been going up at one rate and we have been able to actually construct facilities at a different higher rate. These two curves have crossed and we are now starting to slow the program down to stay within our bonding limitation. As I mentioned, last year we awarded over 400 million in construction contracts. This fiscal year [1971-72] we will have a bonding limitation of 250 million and next year less than two million.

Today I would like to discuss the experience we had on the Stony Brook campus. It is one of the four centers in the State University system, and I would like to describe a process that we applied on that campus to expedite the design and construction of facilities.

For a number of years I have been very much aware of the fact that the approaches that we were taking to the designing and construction of public facilities was not at all like the approaches that were being used by private industry where there was a need to get something done in a hurry.

Unfortunately, educational facilities fell into a category where you couldn't measure the value of getting a job done on time. If a contractor was late in completing a classroom facility, there were few ways that you could measure the penalty of the delay. But, if it was an office building and you were late, you could measure this in terms of lost revenue-- rent that was not collected for the space.

Over the last several years, however, we have started to measure this. Construction costs were escalating at a very great rate. On some of the campuses, costs were escalating at a rate between 10 to 12% per year. If you were doing a $10 million facility and it took you a year to complete the design of the facility, you automatically added another million dollars to the cost for escalation.

We became very concerned about this and started to look at different ways that could bring about a faster process. We'd already found ways to overlap the schematic design phase with the design manual phase and get into working drawings, earlier. This was done primarily by not coming up to approval points and waiting decisions, but by making our approvals during each phase. We did not use a schematic report as a basis of getting approval and going on to the next stage; instead we used the schematic report as a record of approvals already given. However, we found that if we compared the way we were designing and constructing public facilities to the way others did a shopping center, it would be like not starting any part of the work on the shopping center until Thom McAn had laid out his shoe store. Any of you that know something about shopping centers know this isn't the way it's done. But, this is the way we were designing and constructing university facilities.

We said that we will not start any part of the design until the university comes in with a detailed program of their requirements indicating precisely what they want. We didn't want to go through a trial and error process with architects and find out after we were partway along in the design, that this is not really what the university wanted, and have to go back and start over. We said, "No, you sit down and detail exactly what you want in terms of a program, list the spaces, list the activities you intend to perform in those spaces, tell us what equipment will be required and what services are needed, and when we have all of this, then we will initiate the design process, and when we are sure the design is right, we will put it out for bids, and if suitable bids are received, we will award contracts.

Most people who have been designing and constructing public facilities over the last 10 or 15 years have become very proficient in doing a detailed job of the programming and then doing a detailed job of the designing, and then finally constructing.

But when you have an escalating cost factor involved you can't afford any longer to do these things in serial process like we have been doing up to now.

I felt it necessary to overlap these steps: overlap programming with design; then overlap designing with construction, therefore, reducing the total project time.

This then became another system. We have been talking about the process more than the product and our operation has been pretty much geared in that direction, to establish a process that will give us a product and focus more on how we could go about doing the work rather than what the product itself might be.

I would like to very briefly outline the process. Change is inevitable, and I think that those of you associated with educational facilities know that over the lifetime of a building in one way or another you start to make changes.

We found in the State University system that buildings that were originally designed as classroom buildings were converted into laboratories and finally into other uses. As we built a library or a science building, we moved these facilities out of the old building and converted the building back into classrooms, seminars, offices and less sophistocated uses.

Just as the nature of the building process is changing; the educational process, the way we

go about teaching, has varied over the years and so we need to provide facilities that not only satisfy the current user's requirements, but will satisfy the requirements of future tenants or users of the building.

We started to look in the direction of a process that would take us from the serial process of programming, design and construction into the overlapping process that would allow phases to proceed somewhat concurrently and, therefore, reduce total project time.

I had been talking about this idea for a number of years to different groups of people, including architects, and I was trying to get something developed. It happened that at one point I was a member of the AIA Committee on Architecture for Education. Tom Bulloch of Caudill Rowlett Scott was chairman of that committee. We had been talking about doing something like this to expedite the total design/construction process and somewhere along the line we tagged a name on it, calling it Fast-track. At the time, CRS was doing dome master planning studies for SUNY Brockport campus. I asked them if they would develop a report for us that might outline some of these processes and procedures. They prepared a report called "Fast-track and other procedures, A General Study of Design and Construction Management", for the State University Construction people have come up with a number of different names to essentially describe a process which brings about the overlapping of the programming, design and construction processes in a way that will save total project time.

The Federal Government calls it construction sequencing. If you compare the serial process with Fasttrack or overlapping phases, you will see that the serial process went up to a point and then at that point waited to get an approval before going into the next stage; and the commitments that were received, whether it be from an owner or a governmental body, were only through the next phase. When you completed that phase you needed another approval and with that you proceeded.

The overlapping process, however, requires a greater commitment. In order to follow this, if you are responsible for administration of public funds, you have to realize that you are making a different kind of commitment than you had in the past; which means that you have to select the right team to do the job and you have to have a good idea of what you want to do before you start.

Implicit in our discussion, is that I refer to design and construction of public facilities for NYS. Under our New York laws we are required to publicly advertise and receive bids for each contract. Therefore, this has to be considered in the process.

There is a way to develop a general program and design of a facility, and at a point you can proceed with the bidding of the site and foundation construction. Meanwhile, you proceed with the specific program and design which leads to building the shell and major mechanical construction. While that is proceeding, you can do the detailed program and design leading to the interior subsystems construction.

Now, this is just one approach; but, you see this is based on bidding three major contracts instead of one contract-- you can shorten the total time period by overlapping programming, design and construction.

The other possibility is to bring into this kind of a system, which is a broad approach to design and construction of facilities, building systems that may be available to you so that you can proceed with some aspects of the design and at an appropriate point bid building systems or components of systems, again reducing total project time.

The conventional process may require, say, an average total time of 158 weeks, as has happened on some of our projects. However, by overlapping just the design and construction aspects of the project, we found that in utilizing pre-selected systems we could save 72 weeks, or 45-1/2% of total project time.

Actually, we found by experience that we could even do better. I had been talking to Tony Adinolfi who was then the general manager of the Fund. Tony unfortunately passed away last spring. He was one of the leading forces of the Construction Fund and very receptive to new ideas that would bring about not only the expedition of the process but also a higher level of quality. We had convinced each other that this was the way to move. All we needed was a project to try it on.

At that time, there was a particular need on the Stony Brook campus to provide facilities for the emerging medical school. We had already under design and scheduled for construction, permanent facilities for this school. But, we needed to get them in business immediately. They could start recruiting faculty and staff and enroll students if temporary facilities could be made available.

This need provided a logical place to apply the Fast-track approach. The people there were talking about temporary facilities to house the medical school. We decided against building temporary facilities. Our experience with other colleges and universities was that temporary facilities were not temporary. They became permanent facilities or fixtures on campuses, and it was difficult to move them after people once began using them.

So, we decided to design and construct the facilities on the Stony Brook campus as "permanent" buildings to satisfy the temporary needs of the college.

Bob Ruckterstuhl, who is one of the directors of design and construction for the Fund, (and one of our busiest directors, since he has responsibility for directing the design and construction activities on three of the four university centers along with two of our medical centers, Downstate and Upstate), was the person we selected to expedite this project.

Phil Meathe had just joined Smith Hinchman and Grylls. He was an architect whom we had worked with on another project on the Stony Brook campus when he was a partner of Bill Kessler. Phil and I had talked from time to time about ways to expedite the design and construction process. The firm of Smith Hinchman and Grylls had been doing this for private clients for a number of years, and we thought that a logical choice was to bring them in and let them work on this particular project.

We put a team together. When I look back at it and try to figure out what our roles were, I look at myself as being the old football coach who was diagramming the plays, and Bob Ruckterstuhl, the fellow who represented the front line and is running interference and blacking the opposition. Phil Meathe was the guy we handed the ball to and said, "Run like hell."

Well, he is still running. In fact right now I am a little worried as to whether we will ever get our football back. [Laughter]. With that I would like to turn the program over to Bob Ruckterstuhl who will outline in detail the Stony Brook SURGE project.

MR. RUCKTERSTUHL: Mr. Matzke has already described Stony Brook as one of the four university centers of the New York State University system. It is located 60 miles east of New York City on Long Island. This was particularly significant to the problem we faced on this project because of the market area in which we were dealing.

To meet the academic program that we have to meet for the campus, we are obligated to about $100 million worth of construction per year. So, we create our own market problem. But, this is very definitely part of the Metropolitan New York market. In fact, most of the trade unions in New York City have jurisdiction in Suffolk County. In fact, it is not only as bad as being in New York City, it is worse. The trade unions insist upon being paid a penalty for travel time to come out of New York City and work at Stony Brook. This has led us to the conclusion that costs at Stony Brook are 103% of New York City costs.

As I mentioned we have the obligation of constructing over a hundred million dollars worth of facilities per year and these facilities were all underway at the time that this project was undertaken. The difficulty was that these facilities were coming in in a particular order, depending upon the size of the programs in which they were organized, and this order was not meeting the

total academic requirements of the University. The academic requirements of the University had various surges that the facilities were not meeting. In order to accommodate these surges we went ahead with this project; and that's the reason for the name, SURGE project.

I don't know whether you can define the term "SURGE building". I think it is easier to describe the problem it meets. Perhaps a definition might be, "a highly flexible facility designed to meet a great variety of disciplines on a short-term basis".

One of the very interesting things about the particular project at Stony Brook is that it wasn't until about three or four weeks before the project was ready for occupancy that the exact occupant of the project was determined. The University was able to defer until that point, which departments were going to move in and how they were going to juggle among their other normal facilities in order to take advantage of this excess space.

The program's reason for existence was the new Health-Science Center which was scheduled to open in Stony Brook in September of 1970. Originally plans had been made for the Health-Science Center to use rental space which private industry would provide. They went as far as to sign a lease agreement and the developer was ready to go ahead, but something happened and it fell through. In December of 1969, about nine months before September of 1970, the Health-Science Center was left with no plan. This is the point at which the particular project started.

Initially the program consisted of 90,000 net square feet for the Health-Science Center, and a hundred thousand net square feet for the arts and sciences-- a total of 190,000 net square feet.

The first thing we did was to throw away the traditional program. One had been written. We completely disregarded it. Instead we adapted a very generalized basic program-- a weighted average of what the traditional programs might be, not only of the disciplines we planned to move in initially, but what disciplines might be using the building in terms of the second user and the third user and the fourth user.

Basically, our program was very simple. We said two-thirds of the space should be capable of being laboratory space; one-third of the space should be non-laboratory space. Ten percent of the space should have high-bay, pack capability and the definition used was a 20-foot clear ceiling. The program was really no more detailed than that. None of the traditional, so many spaces per 500 square feet or any of those things. They were completely ignored.

We did have to define a little bit more what these terms meant and this became a rather difficult problem. We had to work with the architect through rather a series of refinements to what we meant by being capable of a laboratory space. We had to start defining terms, such as, electric load capacity, and how many watts per square foot do you provide in order to have a laboratory of an undetermined type. What kind of heating, ventilating and air-conditioning capacity is needed and should you allow for the possible installation of fume hoods at some future date? These terms were defined in the measurements that the architect's mechanical engineering consultant was able to help us and in terms of anticipating what would be the future use.

The non-laboratory space also needed to have the requirements identified. Even though it wasn't restrictive requirements of laboratory space, we identified that we wanted to be able to move partitions, to make a difference between a seminar room, a faculty room and a faculty office.

AUDIENCE QUESTION: When you make the changes, do you anticipate making them quickly, or simply adapting the spaces and changing the mechanical at some specific time?

MR. RUCKTERSTUHL: The basic consideration would be that these were changes that could be made prior to the beginning of an academic year. It wasn't necessary to move in one day, but, in the months of July and August a basic change could be made all the way from the non-lab to the complete lab space. We didn't have to pay the penalty for overnight change in terms of extreme flexibility.

Now, the schedule, and this, of course, is the most dramatic aspect of the project. I have already mentioned the situation of December 1969 and September 1970. As we got into the project, we thought we would be able to finish up about September 15 to September 20-- the normal time for the start of the academic year.

However, about halfway through the project, we got the unhappy news that the medical school started on September 1st. Therefore, we had about three precious weeks chopped out from under us.

In the Construction Fund we rely strongly on our architect's professional ability to design buildings within our budget. We got a $15 million appropriation, told Phil Meathe we had $13 million to spend, and kept $2 million in our back pocket. [Laughter]. This was really, I think, a very practical consideration. In this broad program, we had no idea how it was going to be modified.

For example, about a month or two into the design, we found the animal facilities were so specialized they couldn't be accommodated within the basic system we had established, and we had to add two or three bays onto the building of specialized construction for animal facilities.

We also saved money for overtime work to assure completion on the deadline.

I would like to mention just a few things about the administration of the project. We used essentially our standard architects' agreement for this very unusual project with one basic change. We said the scope of the architectural services was essentially the same as they would be in a traditional project, but, in lieu of formal reports, in lieu of preparing material for presentation, architectural decisions were to be made in a joint meeting between ourselves, the architect and the user. Even though the scope of services was the same, the services would be carried out in a different order and there would be a different method of obtaining approval.

We added one item and this was the provision of construction management. This was a surcharge that we added to our normal architectural fee. The architectural fee was not a percentage fee; it was an upset limit equal to the percentage. I don't know whether Mr. Meathe is going to take credit for this, but our actual costs were substantially below the upset and this is something I would think very few architects would expect with traditional problems.

Finally, a bit about the cost control system. During the day we are going to give you the cost information on this project, the SURGE project; and also on one of our more conventional buildings, the chemistry building which followed immediately after the completion of the Surge Building with the same approach and the same architects, Smith Hinchman and Grylls. These are not classified documents. We are laying it completely on the line. [Tables 1 and 2].

You will see our original budget of $15 million, that I mentioned, for the Surge Building. You will see the award amounts that we made. I think eighteen contracts were involved. You will see that we had some problems with change orders because of the speed and coordination between these contracts and because of such things as discovering that we needed an animal facility after we were under construction. Change orders were a larger percentage than we normally expected, but I think the important thing is what the total costs, including change orders, are.

If you originally award projects substantially below your budget and have 10% change orders which is about what we ran into on the Surge Building, you are still ahead of the game in terms of the total costs.

Let me give you a few figures that you can use in analyzing the cost sheets. There were 190,000 net square feet, and 275,000 gross square feet. The factor of increase is only 1.5, which was a much more efficient design than we expected. When you are looking at costs, note that the costs, less site work, of approximately $9,300,000 is for 275,000 square feet, and this means about $33 per square foot of building costs.

This site is at the extremity of our campus, therefore, the site costs were rather large, nearly three million dollars. But, the building costs-- $33 a square foot-- compared extremely favorably to the forty or fifty dollars per square foot we were paying for conventional facilities during the same period. So, the cost savings were dramatic.

Many people involved in the process thought that it was going to be impossible, that it couldn't be done. Some of our speakers yesterday seemed to generally accept the idea that with state or governmental agencies, it is impossible to meet schedules.

Well, it wasn't impossible, and let me just describe the final product, the impossible product. We started the design process in December of 1969, December 20th, and occupancy of the first buildings occurred on September 1st of 1970.

The one compromise, of course, with the terrible time schedule we had to face, is that they were one-story buildings. But certainly I don't think anyone could say they are in any way a detriment to the campus environment. (Fig. 1)

This is a beautiful site in a beautiful wooded area, rolling countryside; and the buildings were very carefully placed in that environment. (Fig. 2,3)

The building was divided into zones, and on each of the rooftops, the heating and ventilating and air-conditioning subsystems handle one zone.

We used a five-foot ceiling system. This was sort of an application of the SCSD five-foot module ceiling system. We used the Butler structural grid in the ceiling system. We did not use a five-foot partition system, though, and this is something we felt would be more economical and work out better and we used three, 40-inch panels equal to two modules; and three times forty is 120 inches, which gives us sixty inches and so the module on every other line matched up between the partitions and the ceiling. (Fig. 4)

The buildings are not named. It wasn't the Fine Arts Building or the English Building. It was Building F. Building F this year has the particlar occupants of the English Department, and next year there will be another occupant and two years from now there will be yet another occupant.

One last item as far as the approach-- in particular, the day-to-day relationship that the Construction Fund had with the architects in this particular process; and I think this is probably the key to the whole thing. We never allowed ourselves the luxury in this unbelievably active, eight-month period, of doing things in the normal manner. And we continually asked the question, "What do we have to do in order to accomplish the objective?" And we found out that the answer to that question was-- many, many details.

Let's take one example. We found out that in order to meet the schedule we could only allow seven days for the award of contract. I imagine for many state agencies, government agencies, this is a very unusual accomplishment. The usual time period is 45 days. But we identify that in order to accomplish the objective, the award must be made in seven days. So, we had to do what was necessary in order to award in seven days.

Now, 45 days was a sacred cow for six years. There was no way of doing it in less than 45 days. But, you have to begin by identifying what you have to change in order to accomplish this and we got the answer, and this was carried through in every aspect of the project.

When we had a meeting, the agenda would be: What decisions have to be made today? And then we would make those decisions. It wasn't letting things happen, it was making them happen.

Now, I'd like to turn the presentation over to the man who was able to accomplish the impossible, Phil Meathe of our architects, Smith Hinchman and Grylls.

MR. MEATHE: Because of the time I'm going to shorten what I had prepared, but there are a few additional things that I wanted to say. The first is that until today I didn't know that bastard Ruckterstuhl had two million bucks in his hip pocket. [Laughter].

Secondly, I am considered a pretty good negotiator in my profession, except with that contract of the upset maximum fee on a 2.5 times payroll basis. We ended up giving back to the State of New York, four hundred and ninety-nine thousand. So, I lost my title as outstanding negotiator and I am now known as the dummy in the office. [Laughter].

One of the major projects I will explain to you is this new chemistry building. I purposely have not shown the SURGE building because there are many professionals in the nation who say, "You guys were lucky, the State of New York was lucky. They're one-story buildings with small components; sure they are flexible, and all that other ballyhoo. But the only reason you did it was because you pushed everyone and muddled everyone and fought everyone to do it."

Well, what we are going to show you is a second $21 million building. The accomplishments on this project equal and surpass in many regards the accomplishment on the SURGE project.

Bob mentioned the Surge Building. Now, there were eleven buildings in this first complex. The agreement we made with the Fund as we started the system and developed the management techniques involved, was that we would turn over to them in eight months and eleven days the first six buildings. And in 2-1/2 months after that we would turn over the balance of the five buildings. All schedules were met.

We have calculated that the savings in time over the conventional systems for building in this magnitude was 78%. And the figures have been supported by the State of New York. The resultant savings of escalating costs for this approach has been calculated at $4,500,000, and $3,300,000 savings on potential rent payment if they had had to rent the space.

Bob also mentioned that the reason we did this was to move students in by September. I think what Frank was alluding to really set the stage for this program. All of us that are in the building industry realize conditions are such that you are an idiot to produce a building under the old system. The bugaboo of cost escalation in this nation has been so fantastic that to produce buildings on a step-by-step sequential method forces the owner of any large building to literally have to spend-- because of building cost escalation-- 20-30 million dollars before he even starts construction.

For example, we have a hospital we are building in Detroit at $75 million original cost. By that I mean it is the cost that we have pegged the building at based upon the present going construction costs in the city of Detroit. That building, if allowed to be designed and constructed in the normal manner, would cost $150 million. That's an additional $75 million, or exactly the cost of the building. And this is only because of time.

The factors that make the ball game as it is-- ridiculous-- is cost escalation, and manufacturing technology. We do not use technology that should be used today.

A contractor with any intelligence who submits a quotation on a building with over twelve months' construction time doesn't really submit a bid; he submits a gamble. It is a crapshooter's market, because can't intelligently quote prices on products three or four years from date of bid.

We had another example in Detroit on another large hospital that we now have under construction. It's a $40 million project. When the bids came in under the so-called conventional system, the low bid was $60 million. Obviously, the owner's first reaction was, "Boy, you dummy architects." And the guy is entitled to say that, because you have a $20 million increase at bid opening. After examination of the bids, we discovered in the low bidder's bid, an added line item, which said, "Contingencies and Unknown, $20 million".

Now, why did he add this? By researching this in depth we discovered that where he had a carpet contract estimated at $3 million, the manufacturer of the carpet could not get a yarn price for four years from the date of the bid. If they couldn't get a yarn price, they couldn't very well quote a carpet price. So the carpet manufacturer couldn't intelligently quote a price to the installer, and the installer, not knowing what his labor market was five years from the date of his bid, couldn't intelligently quote an installing price.

So, the carpet that would normally run you a dollar and a quarter, was bid at $6/square foot!

Now, if you are a carpet manufacturer and can't get yarn prices for five years away, what's the logical thing for you to do? It is to take your yarn-increasing cost over the past five years, add it to the present cost, and because you must commit yourself, you add a factor to it.

Because you don't know the labor price in your mill, you go back over your labor history for five years, repeat the process, and add a factor to that. Since the installer doesn't know his price five years from today, he takes the price five years back, and so forth. So, what you are getting is an escalation, escalation, escalation, and then a gamble, unknown, gamble, unknown, gamble, unknown. The resulting bid price becomes ridiculous.

Now, we believe that there can be more intelligent management processes used in the building game, architectural and building construction, that intelligently allows you to provide professional services in a manner that is going to benefit the owner and benefit you as a professional.

Let's review the so-called traditional ball game. First, you award an architect, and if that part is okay, and you get accepted, someone says, "Write a program." Then, after program schematic, comes design. We then go through that old process called design development. And you produce working drawings assuming everything is okay. If you are lucky, you get the authorization to advertise for bids. When those bids come in, if you are damn lucky, and some contractor is stupid, you end up with a price that allows you to start construction.

Again, if you are lucky, you get construction, and more construction, and more construction, and finally you get the damn thing built.

This sequential thing I am describing represents seven years' time. This is the normal time which can be verified by these two gentlemen for a project of the magnitude which I will show you. And to prove that the figure is correct, the project we are showing you was originally quoted on the open market; the bids had to be thrown out. The low bidder had quoted to the owner, the State of New York, four years to build it.

We were brought in at the time of the first bid opening when everything went sour, to see what we could do.

What did we do? We have a program, called the UTAP, Unified Team Action Program. The reason we call it Unified Team is that if you don't have a guy like Ruckterstuhl running the so-called interference and a guy like Matzke with the guts to fight for this thing, you're an idiot to try this program with a client.

Any time you think you are going to use this system and a client is not sure he wants to use it, you're gambling the capitalization of your corporation and you're going to blow it. It will only work if the client has the conviction to change the way he works. Everything we have done in New York has not been because of Smith Hinchman and Grylls, it's been because the owners have the guts to say, "We have committed ourselves to a system, let's see it through to the end."

Now, what's the system? It's a management process that combines the knowledge of the architect, the engineer, and the owner together with the manufacturers, suppliers and contracting industries, thereby forming a unified team which can produce outstanding facilities within budget and time limitations.

What do you expect if you do it? You should get a fantastic reduction in time; you should get a cost savings in escalation; you should get a savings in rental payments if you have to make them; you should be able to get a complete team input that enables you to make intelligent trade-offs between requirements, budget limitations and time factors.

You get major competitive bidding on all your principal systems and subsystems and you get a complete utilization of system and subsystem design.

Now the ball game, as we know it in this country. T-1 is the day you hire the architect and the funds are committed. The hospital I mentioned in Detroit, the T-3 funds used would be $150 million, even though T-1 is $75 million; and the game is to try to find a method to reduce time so that you end up with tremendous time savings which obviously means dollars.

Now the guts of the system. Every activity within a building comprises five functions. The functions are the time to design the activity, the time to bid and award the activity, the time to get the prefabrication information on the activity, the fabrication time of the activity, and the construction time.

Construction time obviously has a start-stop date. The early start date is the result of the impact prior to construction activity, or the impaction of the fabrication time. The latest construction date you are allowed is the effect it has to impact on other construction activities.

Every one of these five items can be compressed. But, when you compress them you have to be willing to pay the cost to make the compression.

Professional design time can be cut down by intelligent use of staff to increase your staff usage.

As Bob said, in bidding an award in the State of New York, normally it takes 45 days. We did it in some cases in seven days. But, in others that were not critical we went the entire 45 days.

The prefabrication information: we would find that we would go to a manufacturer's drafting room and check the drawings right there, approve them, and reduce that time in some cases to three days instead of 14 or 20 days.

Fabrication time: by proper notification on your bid documents, you can set fabrication time on either a 40-hour, 80-hour, or a 120-hour work week, depending upon the impaction of the construction schedule and construction time. By notifying the contractor in the bid documents, you can compress an activity by putting him on a 40- or 80-hour week, if you are willing to pay for it, because of its impact on the next activity in the line.

Now, what is this all about? You take your building activities, if there are a million of ti in the left-hand column, assembled in what we call building packages. These packages are then taken and checked against the construction market and the trade unions.

If the package assembly is right, and we believe we established it in the marketplace, we then set the priority of the package. When the priority of the package is set up, we then value the package. By that we recheck it against our budget control and then recheck it by finding out what it costs us to compress or increase the time framework

In some cases you may compress the package, pay a million dollars to compress it, but the end result may be two million savings. So, it is important to know what the dollar impact is to expand or to compress.

When you complete that, if your budget control is wrong, you go back and redesign; if it isn't, you go back out and place it on the marketplace and then you get your bidding; and you evaluate the bid and check against your budget control. You have two factors to recheck; you recheck against your budget control and either redesign it because you have lost control, or you proceed with construction.

What do we do now? We complete the schematics normally as you do with any other project. When they are done, the architect and owner should really know the contents of his building. He should be able to say to himself, "What makes up my building in contract packages?"

What do we do, when our schematics get to the 80% mark? We bring in our construction managers. They take these drawings, break them apart and say, "If we were going to build that building based upon what we see now, these are the package assemblies that we need to build that building."

If you know the packages, you can intelligently say to yourself, "What is the minimum construction sequence I need to make those packages?" So, you have used a "package" to develop your construction logic. You are still in schematics when you have construction logic and the packages that you need for the marketplace.

You then go ahead and say to yourself, "What is the design logic to make my construction logic function for the packages I have assembled?" You then develop your design logic. When the owner approves the schematics, he approves the package assembly, the design logic, the construction logic of building that building. That is roughly how we do it.

Now to the $21 million graduate chemistry building. What we did when the schematic design was nearing completion was to sit down and say, "These are all the major systems in that building needed to build it;" then we said to ourselves, "How do we assemble these things in the building packages?" So, we used color coding in the assemblage of the activities into packages.

The construction logic of this $21 million is a network, the very basic CPM network of all construction activities.

We put that activity network together, and we notify the owner that we have to be willing, if we have a slippage on an activity on top, to act immediately to determine what course of action to take. Do we pay that contractor a premium to go on overtime, because his end date will have major effects on the other one? Or do we go ahead and say, "Take that slippage, and pay the man beneath him. Give him a change order to increase his staff." And, so, what we are doing is we are taking the end date of any activity and the start date of the activity behind it, and are constantly adjusting them. Each of these construction activities are broken down into elaborate CPM's and we know exactly each function of that construction activity, how many feet he is going to pour per day, how many yards per floor material or

wall material or whatever.

So from that construction activity we then assemble this design activity, and this design activity shows what we must do in our office to design it in order to send that activity out in the marketplace, to get the shop drawings, and to approve the fabrication time.

All of the construction activities and that whole network from beginning to end is exactly set up on this particular job for 26 months; and today we have 54% done-- as of last evening-- and we are exactly eleven days behind schedule.

Now, to give you the highlights of this building-- it is 312,000 square feet... Ruckterstuhl and his lovable kindness, you see, he doesn't tell me what he's got in his hip pocket; and I imagine he has about $6 million hidden someplace else and I will find that out later in another one of these lectures. [Laughter]. You know, he is a very quiet guy: "Oh, Phil, it's all we've got; you've got to do it." You know, watch! I'll find out it will be five million or six million.

He said to us, "The latest date we can accept this building is September '74. But, if you can get it in by September '73, we will love you." We are currently expecting to give it to him in July of '72-- that is, we anticipate being able to turn it over to him in twenty-six months from the date we started to design the building.

VOICE: May I just ask a question here? What is the point of that? Why didn't you start the building later?

MR. MEATHE: Well, the user certainly would like to have the building. The time that he wants it is the latest time that he can possibly accept it. The sooner he gets it, the happier he will be.

MR. RUCKTERSTUHL: At the lowest cost, too.

MR. MEATHE: The lowest cost. The latest date was what everyone would assume to be the most practical date they could get it.

VOICE: Well, you still have to operate; you still have to pay to keep the building there. You have got it, and you have got to pay for it.

MR. MEATHE: The faculty is going to use it.

And the owner will have that building in July of 1972; and he should have it at a savings on the escalation-- to be sure you understand the figures, if you were to take that normal building over a seven year period of time, the savings this man will receive in savings of escalation and rent payment he would have made between the twenty-six months and the seven years exceeds the cost that he will pay for this building. It exceeds $20 million.

As of now, he has a savings, I believe, of a million nine hundred thousand under his original budget, plus all the contingency money that he has set aside and expected to spend.

Thank you.

MR. MATZKE: Well, this has been somewhat of a Fastrack presentation of what we have been doing. [Laughter].

We are running behind schedule and I don't know if we have time for questions now; but if I could just summarize in terms of what we have been able to do-- I don't want you to leave this meeting thinking that we are doing all of our work this way.

I would say that about 95% of the work that we have accomplished to date has been done essentially by the conventional process, the serial process of preparing documents, putting it out, awarding a single bid to a general contractor, giving him the responsibility of getting the job done and so forth. But we are finding lately that if we don't follow this process, particularly on large projects, we can't do the projects at all.

The secret nowadays is that in the past you took an owner's program and started to work with the functional relationship of spaces, playing around and coming up with a bubble diagram that says this space has to relate to that space, and so forth; going then into a relationship to the site and circulation and utilities. This accomplished a solution to the owner's problem which satisfied all of his area requirements, and his functional requirements. But that approach overlooked a major requirement, which is to be able to get the job done within the owner's time frame and budget.

So, the thing that we have introduced into the process is a look at the whole process. How is this building going to be constructed, and particularly, how is it going to be packaged and offered to the construction market?

If you don't consider the market in which you are going to build the facility and the best way to get that facility built within the constraints of that market, you don't have a chance of getting the facility done within your time frame and budget.

So, that what we have now brought up very early in the process is to look at the market and say, "How are we going to package this project and how are we going to put it out?"

Interestingly enough, our experience shows us the only way to control costs on the project is to break the whole into as many pieces as possible and control the cost of each of those pieces.

This may sound a little dangerous, but actually it is the only way you can do it. We had the experience on one project that when one of those pieces did get out of line, we were able to recycle, rebid and get back on our original time schedule.

There are a lot of things that we found by applying this process. You don't have to do it in every project in the same amount of detail that Phil has indicated. We have found it gives you other options in the design of a medical school, which Bud Goldberg is doing for us; it is a great megastructure and it has some problems. Bud was proposing a reinforced concrete structural system, and we had some apprehension about this. In the Stony Brook market we were already doing a particularly large amount of concrete work.

So, we convinced Bud that it was worth our while if he would also design a structural steel system. We would then put both on the market at the same time, making proper allowances for the concrete that would be needed to fireproof the steel.

By putting both systems on the market and bidding them at the same time, we realized that the steel system was the more economical in that particular set of circumstances.

I think this is the name of the game today. You have to look at a project in terms of how you are going to build it, and how you are going to market it. If you don't do that, you may not have a chance in our escalating market of getting the project done within the constraints of time and budget, which to us is as much a part of the design process as anything else.

Thank you.

BUDGET ESTIMATE, AWARD AND FINAL COST COMPARISON ANALYSIS SHEET

DESCRIPTION	APPROVED BUDGET ESTIMATE	AWARD AMOUNT	AWARD -DEFICIT +SURPLUS	CHANGE ORDERS TO DATE	ANTICIPATED OR PENDING C.O.	ESTIMATED TOTAL C.O.	C.O. / AWARD =%	FINAL COST AWARD + C.O.	BALANCE (BUDGET - AWARD + C.O.)
Foundations		150,000		+ 17,189	0	+ 17,189	+11.5	167,189	
Site Utilities		260,000		0	0	0	0	260,000	
Exterior Walls		1,397,000		+ 77,956	+ 9,200	+ 87,156	+ 6.2	1,484,156	
Concrete Slabs		124,932		+ 9,988	- 22,481	- 12,493	-10.0	112,439	
Alterations		264,423		0	0	0	0	264,423	
Structural Steel		579,000		+ 65,248	0	+ 65,248	+11.3	644,248	
SUBTOTAL "SHELL"	2,750,000	2,775,355	- 25,355	+170,381	- 13,281	+ 157,100	+ 5.7	2,932,455	- 182,455
Interior Partitions		574,700		+ 5,420	+ 93,200	+ 98,620	+17.1	673,320	
General Building Work		638,000		+ 36,944	+106,000	+ 142,944	+22.4	780,944	
General Building		658,000		+ 49,210	+ 4,500	+ 53,710	+ 8.2	711,710	
Signage Graphics		8,555		0	0	0	0	8,555	
SUBTOTAL "INTERIORS"	1,870,000	1,879,255	- 9,255	+ 91,574	+203,700	+ 295,274	+15.7	2,174,529	- 304,529
A.C. Units		698,000		- 17,148	0	- 17,148	- 2.5	680,852	
Underfloor Ducts		89,100		+ 91,608	0	+ 91,608	+102.8	180,708	
Light Fixtures		320,500		0	- 9,700	- 9,700	- 3.0	310,800	
Mechanical Work		802,000		+125,035	+ 80,000	+ 205,035	+22.5	1,007,035	
General Electrical Work		766,000		+215,217	+ 71,673	+ 286,890	+37.4	1,052,890	
Electric Generators		81,668		0	0	0	0	81,668	
Refrigeration Equipment		36,260		0	+ 2,870	+ 2,870	+ 7.9	39,130	
General Mechanical		719,727		0	+ 60,000	+ 60,000	+ 8.3	779,727	
General Electrical		757,000		0	+ 88,437	+ 88,437	+11.7	845,437	
SUBTOTAL	4,400,000	4,270,255	+ 129,745	+414,712	+293,280	+ 707,992	+16.6	4,978,247	- 578,247
Lab Equipment	1,980,000	333,663	+ 1,646,337	0	- 25,000	- 25,000	- 7.5	308,663	+ 1,671,337
Special Fund Estimates	0	85,531	- 85,531	0	0	0	0	85,531	- 85,531
TOTAL BUILDING	11,000,000	9,344,059	+ 1,655,941	+676,667	+458,699	+1,135,366	+12.2	10,479,425	+ 520,575
Grading	0	317,000	0	+105,542	0	+ 105,542	+33.3	422,542	
Site Utilities	0	1,688,000	0	+305,243	+ 72,600	+ 377,843	+22.4	2,065,843	
Finish Sitework	0	948,000	0	0	-290,049	- 290,049	-30.6	657,951	
Planting	0	63,365	0	0	0	0	0	63,365	
Signage Graphics	0	30,000	0	0	0	0	0	30,000	
SUBTOTAL "SITEWORK"	2,000,000	3,046,365	- 1,046,365	+410,785	-217,449	+193,336	+ 6.3	3,239,701	- 1,239,701
CONTINGENCY	2,000,000	0	+ 2,000,000	0	0	0	0	0	+ 2,000,000
TOTAL PROJECT	15,000,000	12,390,424	+ 2,609,576	+1,087,452	+241,250	+1,328,702	+10.7	13,719,126	+ 1,280,874

Table 2. STONY BROOK GRADUATE CHEMISTRY 10/22/71

BUDGET ESTIMATE, AWARD AND FINAL COST COMPARISON ANALYSIS SHEET

DESCRIPTION	APPROVED BUDGET ESTIMATE	AWARD AMOUNT	AWARD -DEFICIT +SURPLUS	CHANGE ORDERS TO DATE	ANTICIPATED OR PENDING C.O	ESTIMATED TOTAL C.O.	C.O. / AWARD =%	FINAL COST AWARD + C.O.	BALANCE (BUDGET - AWARD + C.O.)
Excavation	310,000	237,000	+ 73,000	+ 40,762	+ 3,823	+ 44,585	+18.8	281,585	+ 28,415
Foundation	418,000	455,700	- 37,700	+ 11,593	+ 35,613	+ 47,206	+10.4	502,906	- 84,906
Structural Steel	1,400,000	1,222,550	+ 177,450	+188,765	+ 29,282	+218,047	+17.8	1,440,597	- 40,597
Elevators	323,000	352,800	- 29,800	0	0	0	0	352,800	- 29,800
Lab Equipment	1,430,000	1,720,345	- 290,345	0	0	0	0	1,720,345	- 290,345
Floors & Stairs	1,340,000	989,877	+ 350,123	+117,376	+ 5,352	+122,728	+12.4	1,112,605	+ 227,395
Building Enclosure	2,150,000	1,720,000	+ 430,000	+ 37,300	+ 11,483	+ 48,783	+ 2.8	1,768,783	+ 381,217
Plumbing	2,404,000	1,427,000	+ 977,000	+ 6,848	+ 3,500	+ 10,348	+ 0.7	1,437,348	+ 966,652
Partitions	1,130,000	1,397,000	- 267,000	0	0	0	0	1,397,000	- 267,000
Electrical	2,550,000	2,696,900	- 146,900	+ 3,964	+ 5,000	+ 8,964	+ 0.3	2,705,864	- 155,864
HVAC	3,435,000	2,928,240	+ 506,760	0	+ 45,000	+ 45,000	+ 1.5	2,973,240	+ 461,760
Insulation	610,000	290,977	+ 319,023	0	- 4,176	- 4,176	- 1.4	286,801	+ 323,199
General Building Work	2,620,000	1,310,000	+1,310,000	0	+ 21,000	+ 21,000	+ 1.6	1,331,000	+ 1,289,000
Service Facilities	500,000	811,737	- 311,737	0	0	0	0	811,737	- 311,737
	20,620,000	17,560,126	+3,059,874	+406,608	+155,877	+562,485	+ 3.2	18,122,611	+ 2,497,389

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Photographs by
Smith, Hinchman & Grylls Associates, Inc.

SYSTEMS HEALTH BUILDING

R. H. GOODMAN, E. M. HOSKINS, P. WARD

U.K.

MR. GOODMAN: Although you will be hearing three speakers this morning, we are speaking on behalf of a large multi-disciplinary team covering not only the architects, engineers and computer technologists but the planning nurses and doctors and others engaged in the health planning field.

The purpose of this paper is not primarily to produce an erudite exposition on the planning and construction of hospitals but to demonstrate the direction in which technology is moving, taking as our example, possibly the most complex of all building types, namely hospitals.

Perhaps firstly I should describe the planning and construction processes within our National Health Service. Both the capital and revenue findings of all our hospital projects are centrally financed by the Department of Health and Social Security. The executive work, however, of building and running the hospitals is carried out by 15 Regional Hospital Boards, each one covering a population of between 2 million and 6 million. The Department of Health and Social Security has a large multi-professional team consisting of architects, engineers, quantity surveyors, doctors, nurses and others, in total about 300 engaged in the health planning field.

Most of their efforts are directed into the Research and Development Sector, of which the work we are going to describe today forms a major part. Similarly each of the Regional Hospital Boards has a professional structure consisting of the same professions headed by Chief Officers whose major responsibility is to carry out or commission the carrying out of all hospital building in their Region.

There is at the moment a major portion of the health (as distinct from hospital) work being carried out by the various Local Authorities covering health centers, old peoples homes and other similar health buildings. However, within the next two to three years this will be amalgamated completely into the National Health Service.

The scale of investment in health building is large; something over £40 million a year on local authority buildings in the health field.

The work that we will describe is probably the most advanced in the field of computer aided design currently in progress and it is not wholly accidental that this work is taking place at the DHSS. The fact that there is a large centrally monitored on-going programme of building, that relations between the Department and the National Authorities are good and that a fund of research and development data has been built up over the years, all contribute to making the situation ripe for this technology.

The planning of hospitals has all the problems that are inherent in the planning of other building types, except that they tend to be magnified; that is, the relationships between the functioning parts of the building are complex, the environmental services are critical and changes in technical (in our case medical and nursing) management techniques are considerable and unpredictable. These are the problems that are faced in the context of an apparently irreducable time normally taken in the design, production and construction stages of these buildings, assuming that we continue to use all of the traditional techniques.

It has long been felt that hospitals were unique buildings serving a unique collection of clients and a unique community, but there is something esoteric in their design that can only be understood by specialists, and that no two problems are the same. A series of research and development projects carried out by the DHSS attempted to rationalize some of these beliefs and attempted to simplify the apparent conflicting requirements of the various parts of the hospital and the various users. In building terms this meant attempts to reduce the construction to the lowest common denominator compatible with housing dissimilar functions, to identify the common functional elements and those which were interdepartmental and to go further into the rationalization of the construction in an attempt to find a system of modular or dimensional coordination.

A first project at Walton Hospital, Liverpool, managed to accomodate a variety of differently functioning departments within the same structural envelope which in itself allowed for the high degree of environmental services integration. The building was industrialized, pre-cast and capable of rapid erection. Further studies culminated in a design for Greenwich District Hospital which was completely air-conditioned and has a sophisticated system of environmental control. The structure is totally pre-cast, highly dimensionally disciplined and at the same time houses all the departments of a normal general hospital. Its structural components having been reduced to four basic elements--the columns, the beams, the slabs and the fascia panels--which were constant throughout the entire building and in fact gave it its architectural character. At the same time certain key elements to the management of the hospital were identified in terms of movement and communications; and considerable studies were done to measure and monitor these movements.

It was hypothesized that if the communication system at the hospital was the key to its planning and if its communication system could be "generically" typed, then it would be possible to build up a range of hospitals with identifiable and measureable communication patterns, together with the standardized planning components. Based on researches on earlier projects mentioned the likely communications (or Har - ness) shapes seemed to be the ring main, the T the H the L and the Linear patterns each of these having of course different communication characteristics. Matrices were developed to determine the ideal relationship of the various departments of the hospital at the varying scales of size. Some of these relationships could be variable and size dependent such as the relationship between stores and wards but some were virtually absolute such as distances between surgical wards and theatres. At the same time feasibility studies were carried out to determine whether a structural envelope was possible for all parts of these hospitals using the expertise already available from the Walton and Greenwich studies. Structural and economic investigations coupled with the decision not to generally apply full environmental control to the building led to the final adoption of a 15.3 metre span structure with a secondary dimension of 5.1 metres; limiting the height of the buildings to 4 storeys. This seemed to provide the right balance between economic structure and the communication requirements of the hospital. After a series of studies in cellular growth patterns of buildings it was decided to use a chequer board pattern for a development for all the departments of the hospital linked to the harness zone at one end and extended outward in preferential series of profiles.

At this stage of the development the Department asked for and received the assistance of a number of Regional Hospital Board Design Teams in the preparation initially of standardized operational policies and later in the actual design of the specialized hospital departments. The standard operational policies which were designed to be nationally applicable were used as the guidance for these multi-disciplinary design teams set up in the participating Regional Hospital Boards. It was the task of these teams to design a range of incrementally sized departments that could cope with the district general hospitals currently being designed up and down the country and in conformation with the draft operational policies already agreed. A considerable amount of expertise already existed in Regional Hospital Boards in different building types and teams which had specialized knowledge were selected for the appropriate hospital department.

Following this project two identical hospitals were built at Bury St Edmunds and Frimley utilizing the experience of industrialized building, repetitive structures and communication systems confirmed at Greenwich. Although the buildings were exercises in economical building, their real value was not as cheap buildings but in the fact that two identical buildings were constructed for different clients serving communities some 200 miles apart.

This was probably the water-shed in standardization in that clients, traditionally highly individual customers, were prepared to accept a standard solution, providing of course that the standard solution was sufficiently flexible for their needs.

Concurrently with these exercises the Department was engaged in the rationalization of the various structural and constructural components of health building not only in their dimensions and design but in the processes by which this information passed from designer to manufacturer to constructor. The communication of information is one of the major problems within the building industry and seemed very susceptible to a systems analysis approach. The CUBITH* method consists of six basic sub-systems within a total system and comprises briefing, designing, production material, construction, commissioning and an evaluation sub-system. These sub-systems presume the construction of a data bank consisting of a series of data bases which will be constantly updated. Our present efforts will concentrate on three major sub-systems governing the production material and construction processes and will apply these to the standardization projects. At the same time work was started in an attempt to relate this systematic approach to ADP techniques taking the premise that it was possible to use systems without computers but not computers without systems.

At this stage the Department extended its research and development effort into an exercise in the feasibility of planning standardization in the context of a systems approach to the briefing planning and construction process. Preliminary work had already been carried out into the standardization of two departments of a hospital, namely wards and maternity, with only limited success. However if as seemed likely the "climate" was right for the acceptance of standardization, how could this possibly be achieved bearing in mind that to be fully effective it should be nationally acceptable?

Although the systems side of this exercise was already committed to ADP, exercises were now carried out to see whether this highly dimensionally disciplined type of development was applicable to computer aided design techniques. It seemed that this form of planning was in effect playing a game of three dimensional chess which could equally well be played by the use of a computer, assuming that the computer could be programmed to know the rules of the game. The large integrated system which was necessary could only be justifiable if there was some form of coordinated loading methods in order to realize the full economic potential in a way that manual methods cannot. And also this system could only be commissioned by a large organization such as DHSS although it could be subsequently and profitably used by Regional Hospital Boards and private consultants. To this end work was commissioned with ARC and BL. Ed Hoskins of ARC will continue this part of the story in due course.

*Coordinated use of Building Industrial Technology for Health

MR. WARD: Mr. Goodman has just outlined our concept of systems building. He mentioned the various sub systems and how these are supported by Data Bases. It is my task to say a little about three of the data bases as they relate to the Harness Programme of Hospital Building.

The three data bases I shall talk about are:

1. The Manufacturers Data Base.
2. The Activity Data Base.
3. The Production Documentation Data Base.

Firstly, the Manufacturers Data Base.

This concerns the Building System-- the Hardware

In parentheses I would point out that I have used the expression Systems Building and Building Systems and I trust that from the context of their use you realise what we mean by the two terms.

By Systems Building we mean a total system right through from inception to evaluation.

By Building System we mean Hardware.

So then, the Manufacturers Data Base.

What I shall describe is not a closed system in the sense that it relies on any one manufacturer's products for any particular part of the system. Although there is at this time a rigid dimensional framework applied to the standards programme, we have been anxious to enable users of the system to opt from a range of manufacturers and products depending on cost, geographical location or especially for cladding, aesthetic predelictions. It is, if you like, the concept of a half-open system.

You have heard that Harness planning at the moment, and I stress that, at the moment requires that the Standard Departments are planned on a chessboard grid each module of which is approximately 16 metres square. The black squares can be considered as the building areas and the white as courtyards providing light and air.

As all good developers of building systems, we looked first at the structure and external envelope. We found that the structure required to be able to satisfy the need to marry together the collections of modules of various shapes which formed the standard departments and, more difficult, the requirement to play 3D chess. In other words, to have the facility to place the modules in varying relationships one above the other. Our simulations have led us to realize that Harness hospitals by their very nature appear organic and very seldom conform to a simple controlled shape.

These factors have led us, after many trials and errors, to adopt an articulated structure, which means that each module is a self-contained structural entity.

Looking in detail at one typical module one can begin to see some of the advantages we have found of this articulated structure. It consists of three 15.3 by 5.1 metre bays surrounded by a 1.2 metre tartan zone. The module is divided into a coarse planning grid of 600mm with a second preference grid of 300mm. The 600mm grid is always adopted at the interface with the cladding so as to reduce to a minimum the range of cladding components. Apart from thin floor slabs these tartan zones are completely free of structural members both horizontally and more importantly vertically. These freeway spaces occurring at controlled intervals have proved vital in achieving a systematic approach to the installation of engineering services. For these engineering services we have adopted a zoned or layered approach. It has been found that 1.8 metres is needed for the services as a general rule with a deeper zone of 2.1 metres in the Harness zone itself.

1.2 metres of this is occupied by structural beams which have been designed in conjunction with the serivces engineers to afford the maximum penetration zones where they are needed most.

The cladding zone, 200mm wide, straddles the centre of the tartan zone leaving a horizontal services zone between the cladding and the structure. In some circumstances when a department is planned it cannot be foreseen if some sections of the perimeter will be an outside wall or an internal interface with an adjacent department. This will often depend on just how a particular hospital is put together.

In these circumstances the cladding zone becomes the partition zone between two departments and thus obviates the need for planning options within one department.

I would mention in passing that some of the standard departments have thrown up the need for a deep plan without courtyards and this can easily be achieved by "dropping", as it were, structural modules into the courtyards. In doing this, of course, the vertical freeways are still maintained at corner column situations.

The structure can be made from either steel or precast concrete and each can be fabricated and erected by a number of firms throughout the U.K.

We are building two small prototype buildings of about a half-millions Pounds each, one using a reinforced concrete structure and the other a steel structure in order to evaluate the use of different materials.

That, then is the broad outline of the structural sub-system.

For the other building sub-systems we were in a favourable position in that for several years now the Department has developed and used a large number of dimensionally coordinated building components. It has proved to be a fairly easy task to use or adapt this range of components into building sub-systems. The sorts of components I refer to include a comprehensive range of storage units; lab fittings; door sets; sanitary fittings and assemblies; partitions; and many more.

These components were developed in the following way. A performance specification, and in some cases design details, were prepared and industry was invited to submit design bids, including costs. We didn't use a purely performance specification

approach.

These bids were evaluated and sometimes modified in conjunction with the manufacturer. Eventually the components were launched on the highly skeptical world. However, about five million Pounds worth ($12.5 million) of these components are being used each year and there is a comprehensive system of testing and evaluating the components in use and for improving or adding to them where necessary.

As with the structure therefore, all the constituent parts of the other building sub-systems can be obtained from a number of manufacturers situated in various parts of the U.K.

Next we come to the Activity Data Base and this, among other things, is a system of selecting the components needed to satisfy a particular user requirement.

We are analysing every separate activity carried out in a hospital. So far we have completed about 80%, and the remainder will be completed in about three months time. When these are completed there will be about 900 activities recorded. These analyses are recorded on Activity Unit Data Sheets.

For example, a sheet records the building components, equipment and engineering terminals required in the preparation of beverages for a 72 bed ward. It covers the beverage preparation, washing up facilities and storage needs for dry goods. Also on the Sheet is a complete schedule of components, services, outlets, equipment and furniture needed to perform the activity.

Another example would be the analysis of a clinical examination activity. Once again all the necessary hardware is scheduled out. Another Sheet records activity requirements for the assisted bathing of a category 5 patient-- that is, a patient who is incapacitated but not completely immobile.

These are examples of the 900 activities I mentioned earlier.

The fitting out elements and engineering terminals, therefore, of any room in the hospital can be expressed as a collection of Activity Unit Data Sheets covering all the activities which take place in that room.

The next step is to record, room by room, the functional requirements of the room as a whole, as regards environmental factors and performance requirements of the main internal sub-divisions of space. This exercise also is virtually completed.

With these two sets of data, the activity data and room data, the selection and coding of components is relatively straight forward.

In support of the components themselves, we have an index of junction situations, which relates to sets of standard junction details. The method of joining the standard components is recorded on detail sheets and the responsibility for providing jointing components is placed on one or other of the component manufacturers. You will hear how these junction details are automatically retrieved.

Mr. Goodman has outlined the way in which the numerous teams have designed the hospital departments. The methodology of component selection and coding H have described means that these teams can produce drawings which form the computer input in the production drawing subsystem. You will hear shortly to what extent we are using computers to produce the production drawings and schedules to support the standard departmental plans. These form the third Data Base I am speaking about today-- the PDDB.

We offer the users of the Harness System then, not just a building system but complete production material, ready for use by a contractor, for all Standard Departments-- about 80% of the total drawings and schedules required to construct a hospital. In addition we provide a methodology for producing the remaining 20% of production material so that a consistent set of drawings and schedules are finally presented to a contractor. I stress again that these Standard packages of production material do not tie a user to any particular component manufacturer.

Harness is a rolling programme of hospital building and from what I have said it will be clear that real possibilities are opened up in the fields of bulk purchase of building components, serial and run-on contracts, and the use of managing contractors for one or even a series of hospitals. All these possibilities are being actively considered and in some instances tested. We have already picked up some guidance from this conference on these matters. The concept of inviting a contractor to become a member of the design team from the very outset is an attractive one. He becomes a member of the team, paid a fee like other consultants for using his skill in managing the construction process-- from which he made no direct profit. This is something we are keen to explore.

This idea has been termed "inviting Daniel into the Lions den", or a "cuckoo into the nest", depending on one's point of view and prejudices.

We are confident that the particular systematic approach to the building process we have outlined will contribute to the achievement of one of the claims made for systems building-- that is, that it speeds up the process.

The average gestation period for a hospital in the U.K. is 56 months-- nearly five years. We firmly believe that Harness Hospitals can start on the ground within twelve months of the start of the design processes. This is perhaps the major contribution, as this speeding up of the process, allied to a vigorous and effective updating programme means two things:

1. A much greater flexibility in the total hospital building programme.

2. You do not start building hospitals which are already out of date.

MR. HOSKINS: Mr. Goodman and Mr. Ward have outlined the role of systems and standards in the DHSS approach to health building and in the course of their exposition have indicated that apart from the development of the design logic of the Harness system and the selection and design of the building hardware components, the other constituent of the system is the extensive use of computer aids in the building design and production processes. I intend to describe the computer systems that are currently under development as a necessary part of the DHSS Systems Health Building effort.

Work is in progress on two separate computer systems which have been conceived as discrete complementary entities and which are now about to be linked. They are as follows:

1. The Development Plan System (DPS). This is a computer aided design system involving the planning of these hospitals at the macro scale. It is being developed by my own firm, Applied Research of Cambridge [England] Limited.

2. The Production Documentation System (PDS) which deals with the extensive automatic data processing task of coping in detail with the production information for the finalized hospital with particular reference to the standard departments. This task in being undertaken by Systems Programming Limited.

A development control plan can be reached from a unique brief of hospital content, as expressed in terms of Harness departments, by the project team using the development plan system. This calls on both information about standard departments and the characteristics of a subset of the available standard building components; that is, those involved with the shell and structure of the whole building.

The production documentation system receives, stores and is capable of implementing updates to the more detailed information which is necessary for the layout or detailed plan of the single department. It is the production documentation interface of the DPS which carries out the collation and detail modification processes necessary to convert standard documentation into that appropriate to a particular hospital.

It is reasonable comment that many aspects of the system being described here are made possible by a high degree of coordination implied within the DHSS Harness project. It is this that makes possible the whole process, from automatic assembly of plausible hospital plans through to automatic processing of on-site documentation. Thus the actual computer software systems as implemented are specific to the task in hand, however that does not mean that the experience and principles involved are not relevant to the intrinsic problems of other building types.

I will now attempt to describe in a little more detail some of the actual features of the system.

THE DEVELOPMENT PLAN SYSTEM (DPS)

The stages of working of DPS :

1. The provision of hospital brief and functional content in terms of number and selection of departments.

2. The provision of operational policies relating departments to one another.

3. The provision of a site determining likely avenues of approach to the outline hospital form.

4. The provision of the designer's requirements to be accepted by the machine. Here it should be noted that any degree of manual interference can be accepted by the machine, ranging from the complete designer's concept of a development plan to none at all. We tend to feel that the mechanism normally used would be to allow the designer to specify all requirements that he considers necessary and then to allow the machine to sort out reasonable plans within that context.

5. The evaluation of that resultant plan so that the designer has an accurate appraisal of the assembly as a basis for his critique of the hospital and so that he can initiate improvements of one form or another.

6. He may then reformulate the development plan if required and reevaluate the result.

7. Eventually he will be satisfied with his solution to the problem and will be able to commit himself to the construction stage in the knowledge that he has reached a well-reasoned compromise.

The work is divided into two separate program packages:

HAP	Hospital Assembly Program
SHEP	Simulated Hospital Evaluation Program

As a rule the working of these programs is highly dependent upon the logic and principles of the Harness concept itself and in many respects they would not have been feasible within a more general context.

The HAP Process

The hospital assembly program is a solution to the specific problem of creating development plans for Harness hospitals. It is unlike many previous attempts to use the computer as a spatial allocation tool in architecture or planning in that it is problem specific with the following very significant features:

1. It depends on designer choice of a circulation route for the development. This is a rational decision as it takes out of the machine sphere many dubious value judgements and allows the designer a great deal of control over the outcome.

2. It manipulates real building blocks--the Harness departments which have known contents and rules of assembly.

3. The traffic relationships between departments of hospitals in the context are already relatively well understood, are not subjective judgements, and are collectable data.

4. It allows the design team degrees of manipulation over the development plan, from non-automated to fully automated.

The design team can input a complete hospital manually, or can let the computer create a possible hospital plan without any control apart from the original delineation of the circulation route or Harness. Its major role however is seen as rapidly completing a development plan alternative when the team has inserted a group of sensible restrictions on the plan, that is, it solves the location problem to minimize internal traffic loads in light of the design team's requirements. It can execute this task rapidly and efficiently and make available these alternative solutions for subsequent comparative evaluation.

5. It works in three dimensions.

6. It attempts to arrive at simultaneous absolute solutions of the problem rather than a sequential placement or component swapping solution employed by more generalized methods. Even within the Harness concept however the automatic simultaneous solution to the whole problem is a very large computing task, and, therefore, the automatic assembly process is split into two separate stages with further design manipulation available at the intermediate point.

Stage 1: CLUSTER

As a response to the input of the Harness the site area in relation to the route is split into zones on each level of the development. The primary stage of the automatic process tests exhaustively the allocation of various clusters of departments to these zones and results in an arrangement giving a minimum estimated total circulation for the whole hospital. This evidence is presented to the design team for appraisal and possible modification.

Stage 2: POSITION

The mechanism which groups departments into clusters takes some account of the compatibility of the shape of departments within that cluster so that compact DPS are formed. This next stage explores the actual department fitting problems within each clustering zone. This system takes account of the internal relationship of departments within the group, the relationships of groups of departments within the remainder of the hospital and the spatial fitting problems of the departments of the groups themselves, both horizontally and vertically.

7. The outcome of this second automatic stage is a layout plan for the whole hospital which is displayed for manipulation by the design team, and it may be stored for further analysis by the SHEP programs.

This outline of the significant features and working of the HAP process has stressed firstly the role of the design team in the DPS process and secondly the relatively rapid response required. This system has always been considered as an interactive design team-computer task. Only recently have definite modes of working for this mechanism been put forward. Initially it was considered that conventional teletypes in various parts of the country would be a suitable mode of working, and the system was originally written with the economical view in mind.

However as the pattern of the DHSS Systems Approach to hospital building has become clarified, and actual modes of working established, mechanisms for visual display of plans via storage tubes have been implemented. Even now the use of a true interactive graphics terminal is not seen as an absolute necessity. This manner of thinking has tempered the writing of much of the program, and the virtual size of the programs has been held down to remain competitive in the Atlas time-sharing environment.

The Building Representation

One of the most significant features of the Harness Hospital DPS systems is the ability to translate from the image of the building displayed at the end of the HAP process, which is solely a demonstration of disposition of parts, into a realistic simulation of much of the hospital which would result from this particular assembly. The vehicle for achieving this is the building representation. It is this building representation which is manipulated by the programs to give indicators of design performance for comparative purposes.

The building representation is translated into several forms suitable for the various evaluative tasks required. In the Harness concept there are two basic planning modules: The 15 meter square planning module which is subdivided into 5 meter square dimensional modules, which form the basis for the evaluative operations. In the course of the HAP process the hospital is held at the level of the 15 meter square to economize on space. However, prior to the SHEP process a conversion and expansion process is required to describe it at the 5 meter square module level. Simultaneously this conversion process creates other description mechanisms such as a compact height description for the whole hospital which allows for description of the location of unfilled structural areas or stilts and also a compact harness description. This mechanism is used more because of computing necessity than for the direct needs of actually running the programs. If the machine available was infinitely large such considerations would not be necessary.

For the computer minded, the HAP process produces a digital image or building description of the DPS, which for a 1200 bed hospital is held in approximately 10,000 48bit words or 60,000 bytes. In other words it is manageably compact. This description is passed on to the second process within the DPS, the Simulated Hospital Evaluation Program, SHEP process.

The SHEP Process

The simulated hospital evaluation program:

This is primarily the mechanism used for the comparative analysis of alternative hospital areas. ARC holds that valid comparison between alternatives is achievable only by a detailed examination of the consequences of the whole hospital assembly. Within the Harness concept it is possible to consider much of the detailed design content of the departments as "sealed" packages which are dealt with in a separate context. However, the comparative analysis is concerned in great detail with those parts of the hospital which do vary according to the total assembly. Thus the SHEP programs are involved in simulating the variations in:

1. Circulation
2. Cladding
3. Environmental performance
4. Energy requirements
5. The Harness
6. Site usage
7. Site works
8. Structure

Logically the manner in which these evaluative processes operate is definable as two separate steps:

1- Automatic design
2- Evaluation of the simulated hospital

The concept of automatic design is significant; it is the process which from relatively small amounts of information held in the building representation "fleshes out" the component detail of the particular building in question, internal to the machine, by depending on the automatic inference of details according to their context within the whole DPS. In other words the machine "knows" the inherent logic of the building method and is able to act on it so as to set up its own basis for building evaluation. These evaluations may take the form of taking off the components identified or calculating environmental loads in the building.

As these evaluation results are produced by the machine, a synopsis can be automatically retained on a special file which can be interrogated at a future date to act as a comparative measure of hospital performance.

The mechanisms of automatic design, as well as providing an absolutely accurate basis for hospital costing by unit components, have simultaneously located all those components existing with the shell, structure, etc. When a DPS is finalized, this information is significant in the production documentation process, and it is possible to hand over such items of information for automatic inclusion within the production documentation system.

For reasons of internal verification ARC has been outputting locational plans of structural and shell elements, and it has seemed plausible that this shorthand locational information simply output to the line printer could in itself form useful production tools. However, the problem of coordination with other production output may invalidate this approach. Nevertheless it is now clear that ARC's output of locational information of DPS will satisfactorily form the basis for collation of detailed information on separate department information into the whole "project file".

THE PRODUCTION DOCUMENTATION SYSTEM (PDS)

Production Documentation for hospital building has always been a task involving the handling of large quantities of data in written as well as graphic form. The computer system currently being developed by SPL (Systems Programming Ltd.) is intended to alleviate and speed up these processes.

Automated design of hospital departments is seen as an extremely complex task and is not attempted within this system, cf. the HAP process; the starting point therefore is a detailed manually designed drawing of a standard Harness department and also a data base of available building components. The system provides for the input of a detailed plan into the machine, its modification and its output in various forms which are suitable for its subsequent use by the design team, the hospital project team, and the contractor as tendering or on-site documents.

The major part of the input process of the Harness department plan for both original and subsequent modifications is carried out using the digitizer and accurate drawings of department layout. These are translated by the digitizer into paper tape using a specially developed Graphic Take-off Language which allows for the location of specific components and their identification by a predetermined code. The information is then read into the computer and verified for both syntax and content. If all is satisfactory the information is translated by the machine into a digital description of the particular department plan; this provides the basis for subsequent manipulation, such as the automatic selection of junction details occurring between components.

It is accepted that the standard departments themselves may well change frequently in detail in response to changes in medical need. In order to carry out this complex task an interactive graphical update system is employed using a small satellite computer linked to the major time-sharing system. This allows for the display of part or all of the plan of a particular department, and it permits the manipulation of the elements of the plan.

After initial input or modification, detailed information is required in various schedule forms to provide the Quantity Surveyor and contractor's estimator with the basis for their assessment of the actual plans. The form of the schedules is flexible and can provide specific breakdowns of information suitable for the various parties involved. Thus, consequent on modifications being made to a standard department, full documentation of the whole and of the modifications is easy.

The volume of drawn material involved in a hospital building is very large; the system is able to produce on demand a wide variety of drawings produced from its standard department data bank.

Having said that the production documentation system is capable of carrying out this degree of detailed work within the hospital building program, it only remains to say that the DPS does not in fact retain or develop a great deal of project specific information which may be thought of as "matrix" which contains the standard departments. The role of the production documentation interface of the DPS will be to set up and trigger off the project specific amendments within the PDS so that correct documentation is provided for each separate Harness hospital.

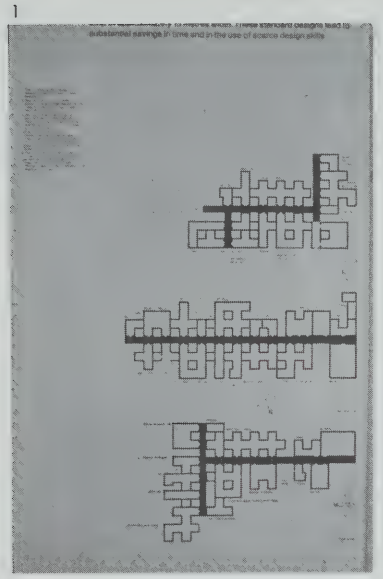
Note: Abbreviations are as follows:

DHSS = Department of Health and Social Security
ARC = Applied Research of Cambridge Ltd.
HAP = Hospital Assembly Program
SHEP = Simulated Hospital Evaluation Program
DPS = Development Plan System
PDS = Production Documentation System

SYSTEMS HEALTH BUILDING: ILLUSTRATIONS

SLIDE NO.	DESCRIPTION
	THE DESIGN PROCESS
1	The Harness, around which departments are arranged.
2	Typical standard planning solution using the 16.2 metre grid.
3	Typical three-dimensional model.
4	" " " "
5	Assembling the standard departments into a whole hospital.
6	Assembling the standard departments into a whole hospital.
7	Computer aided design techniques.
	THE PRODUCTION MATERIAL PROCESS
8	Computer print-out of coded production drawings and component schedules.
9	Detail of computer print-out.
	IMPLEMENTATION
10	A typical Harness hospital, plan.
11	" " " " , perspective.

1



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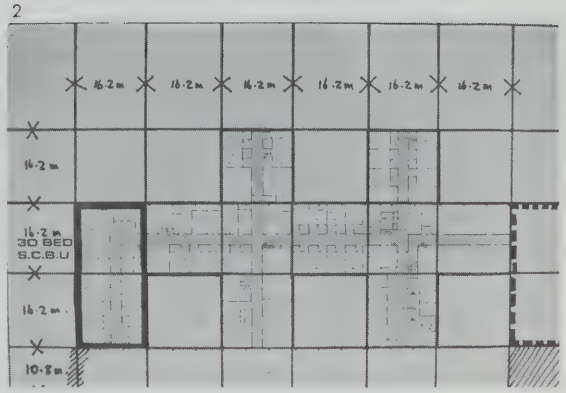
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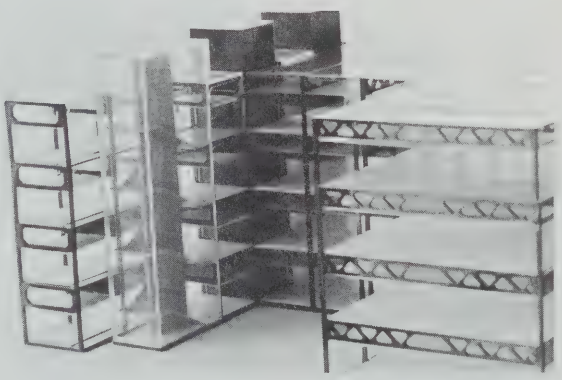

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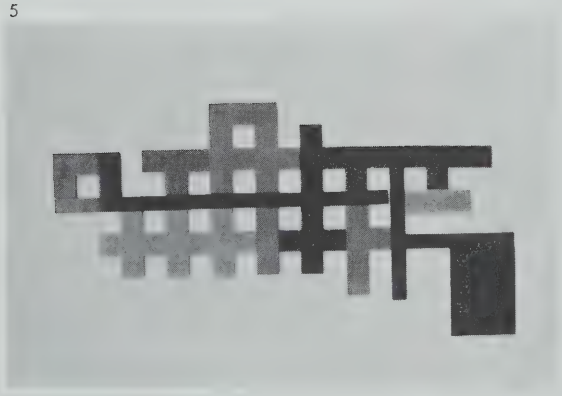

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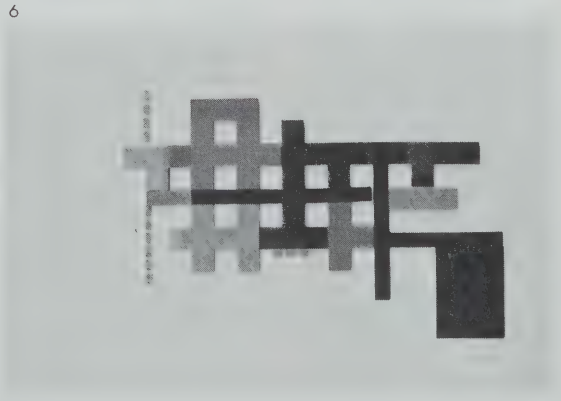

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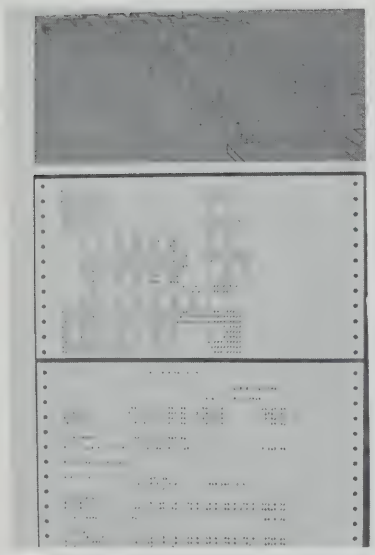

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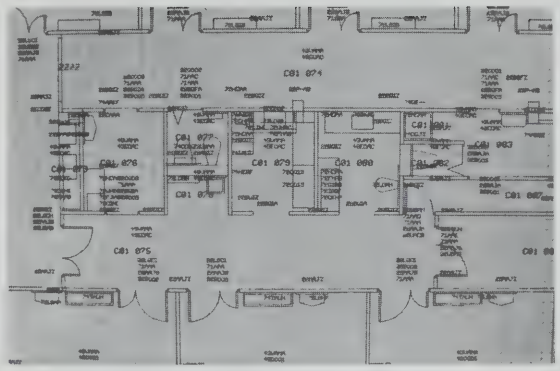

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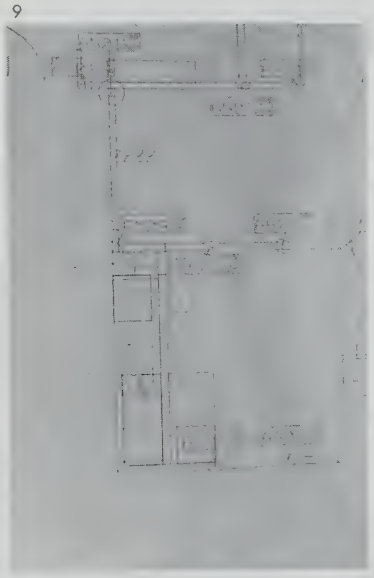

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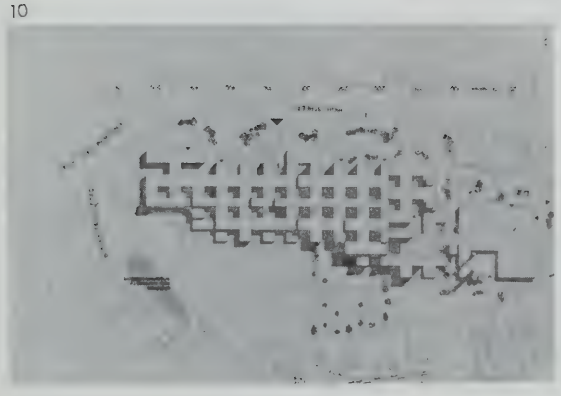

11

A SUMMARY DESCRIPTION OF THE VETERANS ADMINISTRATION SYSTEMS PROJECT

CHRISTOPHER ARNOLD
U.S.A.

For the last four years, BSD has been working with the Veterans Administration to develop a building system for hospitals. For this project, we have established a joint venture with another San Francisco architectural firm, Stone, Marraccini and Patterson, who are recognized specialists in hospital design.

The basic working group has consisted of five or six architects, supplemented from time to time by principals and outside consultants, with the work load split roughly fifty-fifty between the two firms.

The first year was devoted to a feasibility study and generation of alternative system development programs. Of the alternatives presented to the VA in the initial study, the least grandiose was selected; our client was clearly not in a position to sponsor and SCSD or URBS-type project.

The problems facing the VA are classic: escalating costs of construction and operation, coupled with rapid obsolescence leading to general dissatisfaction with building performance. Since the majority of their construction budget goes into modernization of existing buildings, and a sizable proportion of operating funds is spent on more minor alterations, they are acutely aware of the low level of adaptability provided by traditional methods of design and construction.

Systems analysis of the VA's total building production process revealed another issue: a weak feedback link between their field experience and formal evaluations on the one hand, and their programming, design and construction procedures on the other. This situation turned out to be a major factor in the conceptualization of the nature and function of our "final product."

The five broad problem areas--cost, performance, time, adaptability and feedback--were directly translated into project objectives; our system design had to make some significant contribution in each. Obviously, they are all relative. That is, each can be alleviated indefinitely without ever achieving an ultimate "solution." The original project concept was pretty clearly that of a traditional building system, that is, an innovative design for a limited set of building components, more or less in the sense of engineering design.

The particular subsystems selected for our study were structure, ceilings, partitions, heating and cooling, plumbing and electrical distribution. All other subsystems, such as exterior walls, communications and materials handling, were outside our scope. Nevertheless these "non-integrated" subsystems had to be taken into account to sufficient degree to assure their compatibility with the overall design.

This more less arbitrary cutoff, and the arbitrariness of the component categories themselves, have obviously been constraints on system design. Other major determinants have been the requirement of nationwide applicability and the need to conform to all current laws, regulations and procurement policies. Furthermore, the VA was not in a position to guarantee an ongoing construction market which could be used to induce manufacturers to develop new products; we were thus limited to the use of components already in production.

The term used in the feasibility study to describe our general design approach was "systems integration." This was at first taken to refer to physical integration of certain components, such as lighting and ceiling, to facilitate prefabrication of complex assemblies. But it very quickly became evident that the stated objectives would not necessarily be met this way in practical application to the de facto building process. So the interpretation of "integration" was broadened to "coordination." As it turned out, systems analysis of conventional design and construction suggested the need for "uncoupling" various components, such as partitions and services, to achieve the desired degree of adaptability and access. Where the conventional arrangement was, in effect, already over-integrated, our special meaning of "integration" became ironically "disintegration," a word we never actually used for obvious reasons.

Our original building system preconception included the notion of a "design," called contractually the Building System Prototype Design, as a set of detailed drawings and specifications for a unique "kit of parts." The idea was to produce documents which could be directly incorporated into the otherwise conventional drawings and specifications for a series of hospital construction projects, and thereby convert them, or subvert them if you will, into "systems" projects, with all the advantages that are associated with this approach.

A corollary to this early view of appropriate procedure was the idea that we could, and should, attempt an evaluation of available building products in sufficient scope and detail to produce a complete list of those which could meet our established performance requirements.

Our growing awareness of the unfeasibleness of this task was instrumental in the subsequent rethinking of our whole approach. We began to recognize certain implications of producing a general design considerably in advance of any specific construction project which would use it--implications which had escaped our original feasibility analysis.

Similarly, the usefulness of performance specifications--another preconception--became very dubious in the context of the given constraints. (By specifications, as distinct from requirements, we mean legal bidding and contract documents.) After extensive discussion with manufacturers, contractors, our engineering consultants and the VA, we came to the conclusion that there would be no particular advantage to performance bidding within the scope of individual hospital construction projects, bearing in mind that we were not to be involved in new product development.

Running parallel with the process of building subsystem design has been a set of tasks concerned with the development of corresponding architectural disciplines. The intent of these disciplines, or strategies, is to maximize the effectiveness of the various subsystems in their application to building design and construction. The basic concept introduced by the feasibility study, and carried into the initial stages of design development, was a set of planning devices called space modules. They were not modules in the sense of units of length, but were rather units of building volume. They were to have a geometry that would allow them to be assembled in various combinations to produce alternative plan configurations. In other words, they were intended to be basic building blocks for schematic design.

Our final catalog contains eleven simple one story high rectangular modules, ranging in area from about 3300 to 10,500 square feet. The typical forty-bed nursing unit favored by the VA can be provided by one of the larger modules, or two of the smaller.

Each module has been "tested" by planning studies to determine which hospital functions can be reasonably accommodated within its boundaries, and in what ways it can be attached to other modules. Thus, in the process of schematic design, an architect can build up alternative configurations out of these simple large-scale units with a certain confidence that once a specific configuration is selected, he will be able to develop appropriate detailed floor plans within the established boundaries. He also knows which functions can be accommodated in future alterations. In fact, the original detailed plan can be conceptually viewed as the first alteration. It likewise becomes a simpler matter to respond to program changes during the construction period.

However, as our focus shifted from the in-patient bed-care areas of the hospital to the other functional areas and to the hospital as a whole, the space module began to recede to a level of secondary importance. The special design determinants of the nursing wards, such as relatively stable bedroom arrangements and the requirements for exterior exposure (aspect), were not present in the other areas, and thus there was insufficient basis for further extension of the space module scheme. Meanwhile, we had been developing strategies for services which included the decentralization of distribution networks into more or less standardized

service modules. These service modules eventually supplanted the space modules as the primary planning discipline.

Nevertheless, the optimum service module size was estimated to be about 10,000 square feet, which allowed them to be coincident with one or two space modules in the ward areas. In these areas, service module size and shape would still be based on the prior selection of appropriate space modules. Once service module dimensions are set, however, they become the actual planning units in the generation of a schematic design.

The service modules are organized into three basic components: the functional zone below the ceiling, the service zone above the ceiling, and a service "bay" enclosing the mechanical and electrical rooms, service shafts, emergency stairs, etc., at the perimeter.

The functional and service zones are separated by a ceiling designed to act as platform capable of supporting workmen and a limited amount of equipment anywhere on its surface. These zones are in turn separated from the service bay by a shear wall which contributes to the lateral stability of the structure in geographical areas subject to earthquakes or high wind loads. Heavy mechanical and electrical equipment such as fans and transformers is restricted to the service bay at the functional zone level.

In addressing ourselves to the problems of adaptability, construction time, and general building performance, we began to realize that the space organizing skills of architects may often be in a sense misdirected in the traditional approach to hospital design. That is, they may be spending an inordinate amount of time elaborately optimizing floor plans in terms of the original program, as if that program were to remain substantially stable for the life of the building, while virtually ignoring the organization of service space.
Furthermore, evolving medical technology and environmental standards have gradually increased the proportion of service and space to total building volume until it now approaches fifty percent. The coordination of service distribution networks within that space is still largely accomplished in the traditional ad hoc manner, a large number of critical decisions being left to engineers and contractors in the field, neither of whom are normally trained in the skills of spatial organization.

These considerations led us to believe that the usefulness of our system design could be greatly enhanced by incorporating a well developed discipline for service space organization. We were further motivated in this direction after visiting some recent hospitals and laboratories which employed deep interstitial spaces, but with one exception (Louis Kahn's Salk Institute) had not benefited from more than the traditional degree of coordination. It was startling to see service space of twice the normal depth with no apparent reduction of overcrowding, inaccessibility, etc.

The two primary causes of this unfortunate state of affairs were immediately evident: the presence of a forest of fireproofed steel truss diagonals, and the lack of rigorous routing discipline. To this was added the fact that access was seriously limited by widely spaced catwalks. Again the exception was Salk Institute, which has concrete Vierendeel trusses, a continuous platform and highly organized networks. (It was also a solution much more costly that we could afford.)

A cost-benefit comparison of service space provided by deep long-span trusses as opposed to shallow medium-span beams with suspended platform indicated distinct advantages to the latter. The catch, of course, is that the beam structure requires more columns, which can constrain freedom of planning and adaptability.

So we became involved in extensive planning studies to determine the practoca; effect of various column spacing schemes. We found that in the range between the conventional 20 to 30 foot bays and the innovative 90 foot two-way spans now being tried, the most significant reduction of constraint occurs at the low end of the scale. That is, by the simple expedient of using a conventional span in one direction but approximately doubling it in the other, half the columns are eliminated. We judged that this arrangement produced considerable improvements in planning convenience, but that further increases in span did not provide anything like proportional beneficial effects.

Further study of functional space requirements for various activities were required to establish specific dimensions, optimum at least in terms of the VA's current standards. We settled on a single bay width of 22.5 feet for the primary structure, and a range of five spans from 40.5 feet to 58.5 feet on a 4.5 foot module for the secondary structure. This allowed a very shallow overall structural depth which could then justify a fairly deep service space between the structure and the platform ceiling. In fact, one of the advantages of this approach over the typical truss scheme is that structural depth and service depth can be optimized independently, i.e., they have been uncoupled.

In stead of the closely spaced wires used to suspend the typical T-bar ceiling, our more substantial platform would be hung from steel rods spaced at about nine feet along the center of each beam.

Our next task was to develop a basic model for service space organization. Vertical space is provided by stacking of the service bays in a rational array of towers, mostly at the building perimeter. Again, since these towers were not the main vertical support elements, as is typical with wide-span truss structures, their location can be determined primarily on the basis of optimizing the overall service distribution arrangement.

Horizontal space is provided by the service zone between the structure and the platform ceiling. It is conceptually subdivided into a series of horizontal layers called primary subzones, each exclusively reserved for distribution elements oriented in a specific direction. In the top layer, main distribution enters from the service bay and proceeds parallel to the primary structure straight to the end of the service module. Main branches occupy a middle layer and are arranged parallel to the secondary structure. The bottom layer is used for local branches which are once again oriented parallel to the primary structure. Thus each service enters at the top of the service zone and "cascades" downward through the primary subzones via right-angle changes of direction before dropping through the ceiling into the functional zone below. This discipline virtually eliminates cross-over problems.

The first two primary subzones are further subdivided into vertical slices called secondary sub-zones, each reserved for a specific service. The platform-ceiling hanging rods provide the reference points for subzone boundaries. With the exception of gravity drains, all services downfeed through the ceiling. Generally speaking, services are surface-mounted on partition faces and cased in partition furring or proprietary enclosures.

Further along in the project we began to realize that in the process of research we had accumulated a great deal of information which not only served as the basis for our system design, but also was potentially of considerably independent value during building design. To distinguish this class of information from the rest, and to emphasize its longer term applicability, we gave it the formal title of Data Base. Together, the Prototype Design and the Data Base constitute "the system," or the "final product" of the VA project.

The real lesson of an experience like the VA project seems to be not so much in the physical image of the particular design that emerges, as in the vicissitudes of the general concepts that characterize each stage of development. No matter how piously we claim to be avoiding preconceptions, in retrospect they always seem to have intruded themselves one way or another. Even the basic objectives, which may seem quite obvious at the beginning, are not immutable. They react to the actions taken to meet them and are adjusted as understanding of the general problem increases.

We eventually recognized that as far as the VA's long-range objectives were concerned, the Prototype Design was best thought of as a working hypothesis, or model, which could serve as a common conceptual framework for a rationalized design and construction process. In other words, it is intended to be an ongoing aid to decision-making, rather than a "solution" to "the problem."

As such, the Prototype Design is well suited to reinforce the "weak link" in the feedback loop that must function effectively if each hospital is to be a significant improvement over the last. As a working hypothesis, any particular feature can be altered on a purely pragmatic basis as long as the basic disciplines remain intact. Thus each hospital can be expected to have a different specific system design representing methodical convergence on the ideal.

INNOVATION IN THE DESIGN OF HEALTH CARE FACILITIES: SOME INFLUENCES OF SYSTEMS BUILDING

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U.S.A.

Enthusiasm for systems approaches is a natural reaction to the complexities of creating facilities for major health care institutions.

In theory it would be helpful for the designer to receive quantified analytic information about what is needed by the specific client institution. In the case of institutions as complex as the major ones for health care, there is doubt that even the most extensive data collection resources could supply all of such information even at and for one point in time. Furthermore, if we had such a massive collection of data, there could not be sufficient computer capacity to handle it in a meaningful way. In principle, all the information needed could be obtained and analyzed in a scientific way, but the magnitude of the task puts it beyond science. It is "trans-scientific" in Alvin Weinberg's formulation.

The much more pragmatic course of providing quantified solutional information in terms of what to provide will continue therefore to be pursued. There is, however, more than one way to supply this information. What is unfortunately the simplest way is to have it traditionally organized in terms of existing sets of departments, the rooms which comprise those departments and the contents of the rooms, together with inter-departmental relationships between these major space packages which dictate how they are to be located. What results is absolutely concrete and what remains to be done is merely to work out a dimensional grid and to select a structure and components.

If a rigid conventional approach to what to provide is implemented with a relatively closed system of hardware or industrialized building system, indicating how to provide it, we have a situation which is the ultimate in rigidity, one in which the institution's designer not only cannot move but one in which his services are scarcely required.

However, it is generally held that if we have an open industrialized building system of standard components, dimensionally coordinated and subject to dimensional conventions for jointing and tolerances, it would be non-rigid and we need not be inhibited by it in implementing any program of what to provide. What I want to do today is to examine the implications for the design of really open component systems which could meet this end and relate these implications to innovation and the need for change in health care facilities.

To do this I want to consider buildings as belonging to three categories (Fig. 1) in relationship to the disposition of the "works," which are the systems of non-human movement, that is those for information handling, substances and power purveying and commodity handling.

Fig. 1. CATEGORIES OF ARCHITECTURE

Type I. The Architecture of Revealment

Type II. The Architecture of Concealment

Type III. The Architecture of Complement

TYPE I ARCHITECTURE is the oldest and most basic. It is distinguished by the fact that when you are inside you can see what the outside is like and vice versa. It is probably this kind of building that we have in mind when we listen to Louis Kahn's words: "architectural space is a space within which you read how the space is made; within the space, the columns, the beams, and the stones are in the space itself." The most striking examples are ancient Middle Eastern, Far Eastern and African buildings, Byzantine buildings like S. Sophia and some Roman buildings like the Pantheon (Fig.2). There are no surreptitious or unexplained spaces. One might call it the architecture of revealment. I was tempted to call it the architecture of revelation, but that might have implied that it was the omega as well as the alpha.

Plumbing is not hidden in basic buildings of Type I (Fig. 3). It is either slithering along the inside or outside faces or oozing between the two. Decades ago the objective was to get the down pipes outside as directly as possible,

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Fig. 2. Type I Architecture

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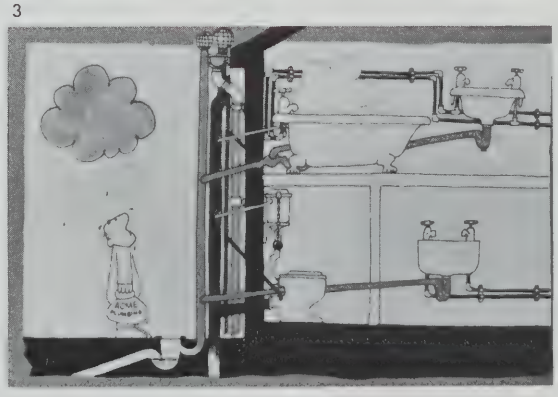

Fig. 3. Type I Architecture: Plumbing

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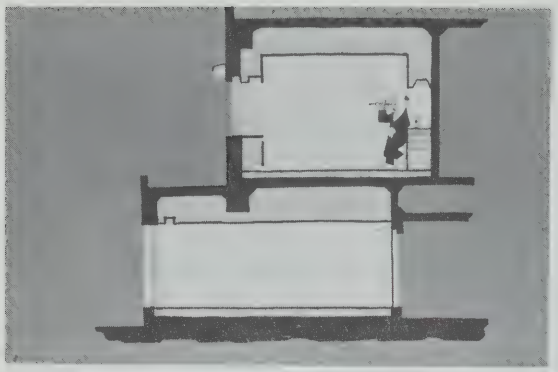

Fig. 4. Type II Architecture: Dead Space

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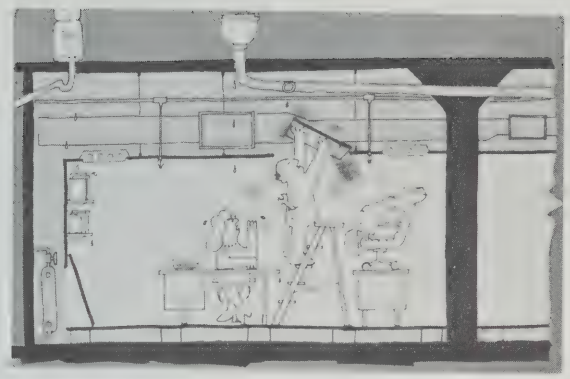

Fig. 5. Type II Architecture: Access Panel

where plumbers were obliged to repair them completely exposed to the elements.

TYPE II ARCHITECTURE is characterized by separation between interior and exterior. The fit, to use fashionable terminology, is loose. The smooth external and internal simplicity of some of the foremost buildings of the Thirties was achieved by constructing rooms within rooms. (Fig. 4). The space between not only housed the works, including radiators, and the structure, but blind boxes, curtain tracks, light fixtures and built-in cabinet work. They were probably the most extravagant interiors of all time, not only in design time but also in construction time. Cabinet work which is all flush requires far more time and skill than does more conventional work which recognizes the natural production processes.

This might be thought of as the architecture of concealment. There are three main subdivisions of it.

When, as in Figure 4, the intervening space is essentially sealed up and inaccessible, I call it "dead-space" architecture.

Those of us who work in office buildings with suspended ceilings are familiar with the next subdivision, "access-panel" architecture (Fig. 5). This is me in my office under a five-foot deep suspended ceiling containing a plenum system of air conditioning. Once every few months I will enter it to find it resembling a coal mine after the filters to the air conditioning system have been changed. Leaks from condensate trays and other sources are not exactly unusual. No doubt we have experienced more than our fair share of misfortunes, but despite it all I think that many of the advantages of access-panel architecture have not yet been realized.

The third subdivision is "crawl-space" architecture (Fig. 6). Here the works are maintained from inside the secret space. This tends to cause less chaos to those inhabiting the primary spaces, but any maintenance man who ventures far into such claustrophobic, dust-insect-and-vermin-laden spaces deserves every penny of extra pay he is likely to demand these days for working in such an unpleasant environment. Indeed I suspect it will eventually become illegal to create any more of them.

There has always seemed something not quite right about Type II Architecture, but is has been okay to turn a blind eye to roof structures. Many famous domes, such as those of St. Paul's, London, and St. Peter's, Rome, are very different inside and out, and the relationship between the internal vaulting of many Gothic cathedrals and the roof structures above is rather tenuous. If designers having impeccable credentials, like the Adams brothers, renovated a handsome, robust Jacobean space, in order to achieve the genteel elegance of a later age, by installing a new ceiling half-way up the windows, lessening the door openings and faking the fireplaces, this creation of one space within another was accepted as the replacement of a good space with what was thought to be a better one. Perhaps the Arras hangings which provided an early example of crawl-space architecture, and what went on in the space behind, lent an air of reprehensibility to the idea of concealed pockets of space.

Though the New Brutalists jolted some of us back rather guiltily to Type I Architecture, it subsequently occurred to me that to avoid losing some of the important objectives in designing a building, it is better to achieve a solution incorporating pockets of throw-away, encapsulated, unused space, or frankly "deliberate mistakes", if you like, than it is to achieve a tour de force in the best traditions of spatial expression and articulation in which every sloped internal plane defining one space is offset on its opposite

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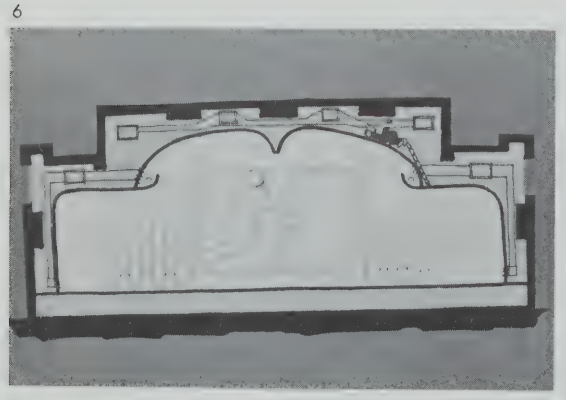

Fig. 6. Type II Architecture: Crawl Space

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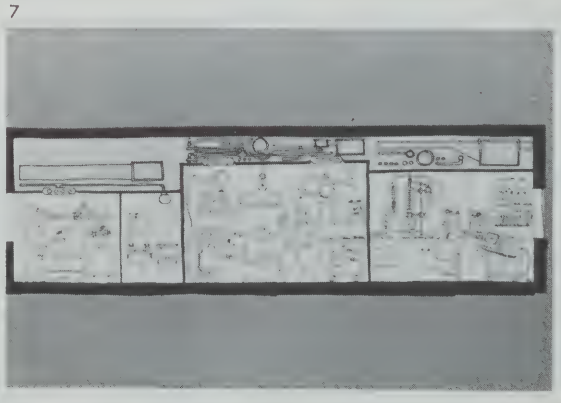

Fig. 7. Type II Architecture: Universal Space

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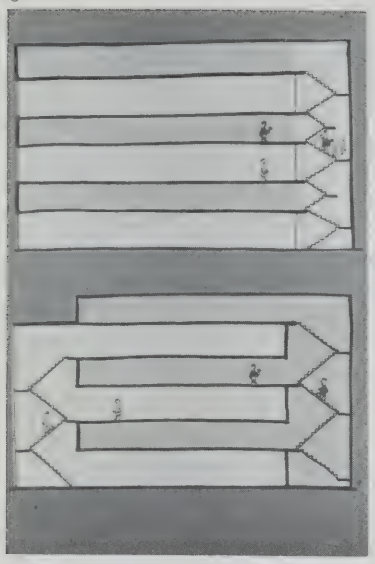

Fig. 8. Type III Architecture: Circulation

face by a reciprocal plane defining another space.

The use of Type II Architecture in attempting to produce a universal space in which, with suitable modifications, almost anything that goes on in a hospital can be accommodated, has appealed to many designers. It is obvious that we cannot carry out to excess the idea of creating any kind of room we like inside another space, so we cannot justify a patient's room inside an auditorium. Quite apart from the spatial diseconomy, patients' rooms must be related to other spaces as a part of a nursing unit of some kind. Treating auditoria as exceptions, an access panel architecture (Fig. 7), in which the ceiling heights can be altered, is the normal version. What happens is that the suspended ceiling depth is at its minimum over the spaces, such as operating rooms, where the need for the "works" is by far the greatest and where they are therefore most cramped.

In TYPE III ARCHITECTURE there are dual systems of man-enterable spaces, one set containing the "works" serving the other set of primary spaces. It is the architecture of complement. Louis Kahn has differentiated between the two sets of spaces by calling them served and servant spaces. Perhaps this distinction cannot be improved upon, but as I am unhappy about the word servant in this egalitarian age, with its connotation of second-class personnel and second-class space, I prefer to call them associated spaces. Not only should it be possible for the tallest employee to stand erect, but for psychological comfort the space should be the same height as the minimum primary space and preferably open to natural daylight and view.

Fig. 10. TYPE III. THE ARCHITECTURE OF COMPLEMENT

PRIMARY SPACES / ASSOCIATED SPACES	A	B
1. Human Circulation	Shared	Separate
ASSOCIATED SPACES: Contained Systems		
2. Character	Simple	Complex
3. Scope	Circulation only	Circulation plus generation and storage
4. Control	Manual	Automatic
5. Terminals	Fixed	Moveable

9

Fig. 9. Type III Architecture: Illicit Storage

To date, associated spaces have largely consisted of elements of the kind known as interstitial floors which house large horizontal structural elements. Vertical ducts large enough to work in have existed with and without interstitial floors, and some interstitial floors are not connected to verticle man-enterable elements.

There are five subdivisions of Type III spaces, each with two alternatives.

The first subdivision (Fig. 8) is concerned with human circulation, that is, whether the system of associated spaces shares a circulation system for access to it with the primary spaces system, or whether the associated spaces system has its own circulation system independent of that required for the primary spaces. When vertical man-enterable associated spaces are part of a dependent system (Fig. 9), the necessary access from the primary spaces encourages their use for illicit storage operations.

The other subdivisions concern the associated spaces (Fig. 10).

The second subdivision is concerned with the character of systems contained in the spaces, whether they are simple for information and substances and power only, or whether they are complex, incorporating substantial commodity handling systems apart from ordinary pneumatic tube systems.

The third subdivision is concerned with the scope of the systems contained: whether circulation alone is accommodated, or whether the generation and storage of that which is circulated is included also. Air conditioning generation split into small decentralized units has been a feature of associated spaces in some recent installations.

The fourth subdivision is concerned with the kind of control used for the systems contained within the associated spaces, that is, whether they are manual or automatic.

The fifth subdivision is concerned with whether the terminals, the vertical elements of the associated spaces system apart from those for circulation of personnel (that is, those for circulation of the contents), are fixed, or whether they can be shifted relatively easily.

Type III Architecture in the interstitial-floor form has also been used as a vehicle for universal space concepts, but as it is more or less mandatory that the floor of the interstitial space be a single plane, a constant height must be maintained for patients' rooms, operating rooms and everything else, which involves compromising with the desirable requirements of each.

However appealing the idea of universal space might be, no space can serve all possible uses. Type III Architecture can, however, allow one space system to complement others, and this can lead to the solution of some complex problems. Our research on the architecture of health care led us from analysis to synthesizing a set of new organizational constructs to which current technology could be applied, thus forming a broad set of hypotheses for the core of the hospital building. There are three static systems of

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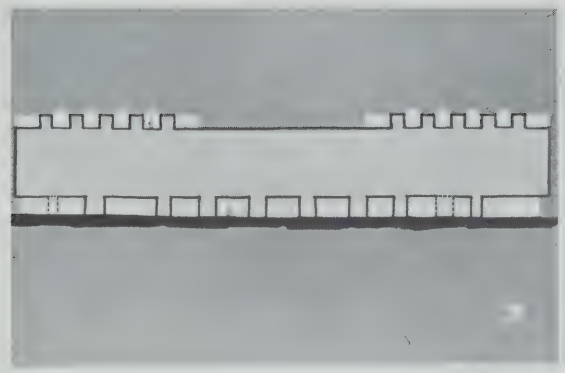

Fig. 11. Type III Architecture: Proposed ITS

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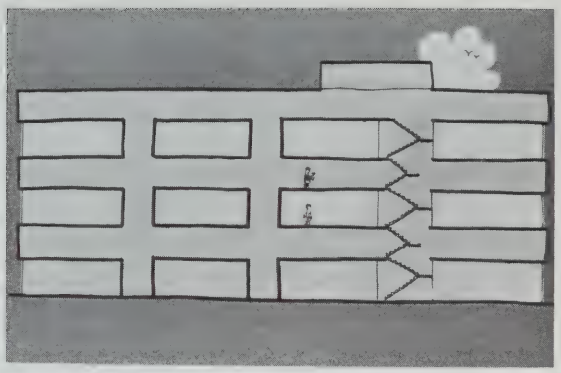

Fig. 12. Type III Architecture: Interstitial ITS

like spaces, and a group of dynamic systems for movement of people, animals, commodities, substances and power and information.

Fig. 11 shows the general relationship of the three basic systems of like spaces. The middle space with man-enterable terminals extending from it is the associated space, the complement of the other two, which are primary spaces.

The upper level, which is the Patient Fostering Spaces, or PFS, is the traditional part of the hospital, where patients are stationed and things are brought to the patients. It is top lit as well as side lit and consists of standard patient stations of domestic scale which do not need to change in size, and therefore the space system has fixed terminals which can contain vertical structural elements. Each patient station is equipped with a Spatial Subdivision System which takes care of the changing needs for enclosure of various kinds, the privacy-companionship issue. Goods handling does not interfere with patient care. The terminals through which goods are purveyed do not form a barrier between patient and nurse.

The lower level, the Consolidated Clinical Techniques Spaces, or CCTS, to which patients go for specific procedures, has much higher ceilings. Because different kinds of spaces are needed, which may have to be moved from time to time, the CCTS is far more complicated than the PFS, and so it accommodates a system of terminals of various sizes which can be moved. It necessitates as few vertical structural elements as possible. This is the kind of space which is most rapidly expanding in hospitals. Because of this and because patients come to it from the community as well as from PFS, it is located advantageously at or near ground level.

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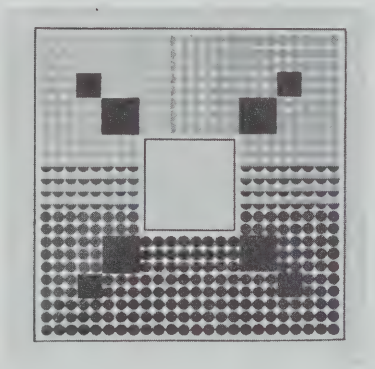

Fig. 13. PFS: Gross Specialty Grouping

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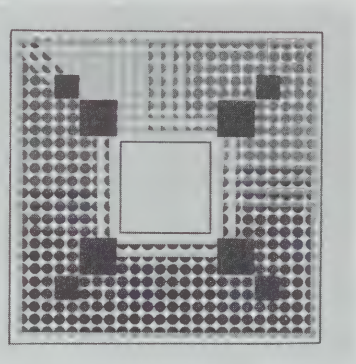
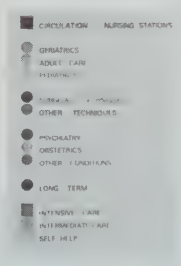


Fig. 14. PFS: Multidimensional Grouping



Legend for Figs 13-16

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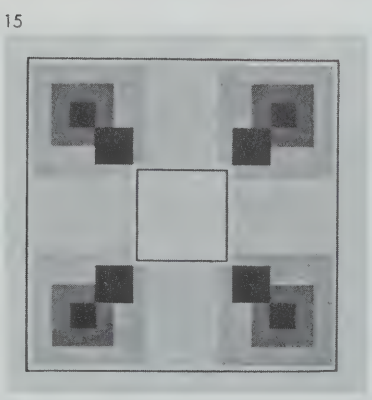

Fig. 15. PFS: Intensity Grouping B

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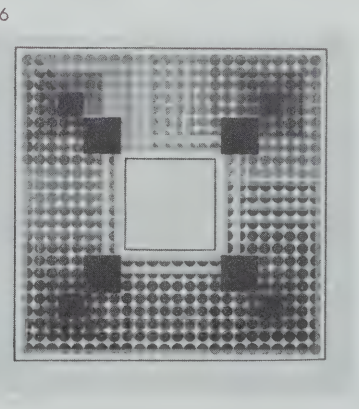

Fig. 16. PFS: Multidimensional Grouping and Intensity Grouping B

The Industrial Techniques Spaces, the ITS, take up the middle. There the generation, storage and circulation of all the non-human dynamic systems takes place, that includes laundry, food preparation, sterilizing, specimen processing, drug dispensing, central storage and emergency as well as regular power. The human circulation of the ITS is independent of that for the primary spaces. Control of dynamic systems can be entirely manual, entirely automatic or anywhere in the spectrum between.

The ensemble is a variation of Type III Architec-

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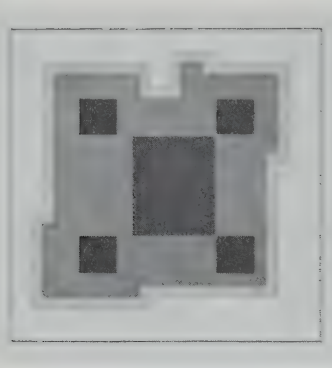

Fig. 17. CCTS: Zones

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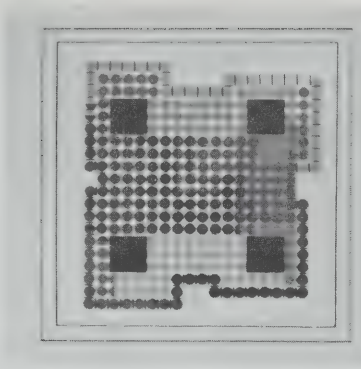

Fig. 18. CCTS: Specialty Grouping B, Phase 1, and Intensity Grouping

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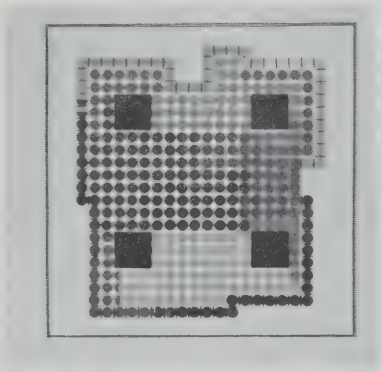

Fig. 19. CCTS: Specialty Grouping B, Phase 2, and Intensity Grouping

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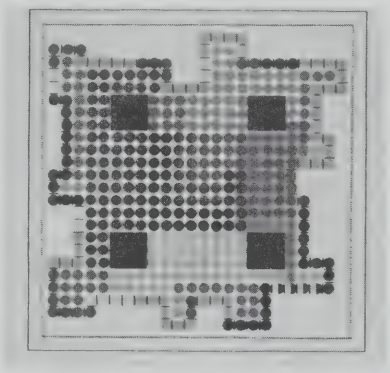
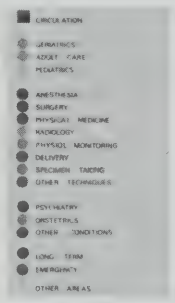


Fig. 20. CCTS: Specialty Grouping B, Phase 3, and Intensity Grouping



Legend for Figs 18-20

ture with a combination of the most elaborate alternatives to the subdivisions of it. The ITS takes up about two-thirds the volume of the building.

If we look for a moment (Fig. 12) at the volume required in an interstitially-floored hospital for the ITS circulation, that is, for the associated spaces, and if we add one-third of the served floor area for generation and storage, the total ITS is about sixty-five to seventy percent of the volume, about the same as our ITS.

The Patient Fostering Spaces are essentially concerned with arrangements of patients and of staff and of environmental adaptations of the patient stations. In Fig. 13* we see a distribution of conventional departments. Great changes in the distribution are readily made. One of the advantages of the system is that you can always start from and return to square one. The half dots symbolize the substantial areas of flexibility. The next illustration (Fig. 14) shows two dimensions of grouping. Here stage of development, the spectrum from infancy to old age, is grouped in a concentric way against the other departments, allowing patients like pediatric surgical patients to be appropriately placed. The advantages of specialist resources are realized, yet travel of specialists is reduced.

Fig. 15 shows a grouping according to intensity of nursing need treated as a matter of distance from the center of each quadrant, where the nursing center is. The last illustration in this series (Fig. 16) shows the three dimensions synchronized. Other criteria can be substituted at any time. They can be differently weighted or a new department or departmental structure can be introduced. Essential to the concept of this system in any sizeable installation is some kind of operational information handling system for locating patients and the supplies they need, as well possibly as a system for personnel allocation.

The next set of slides illustrates the way the Consolidated Clinical Techniques Spaces can grow. It consists of three inner zones (Slide 17). They are the peripheral diaphragm of physicians' offices; the central sterile zone with surgery, delivery and anesthesia; and in the intermediate zone all the other clinical techniques. It is surrounded by a promenade of waiting spaces with coffee shop, newstand, telephones, etc. The glass line shown (Fig. 18), set well in, can be quite irregular. The next illustration (Fig. 19) shows the glass line at the edge of the building above, reflecting an internal expansion, and the next (Fig. 20) shows an expansion of the waiting area (which does not require elaborate servicing) beyond the face of the building above.

With this scheme in mind--one way to solve problems in the design of health care facilities, which utilizes Type III Architecture--we can consider the application of systems of building components. The specific question is: could a component system designed for Type I or Type II Architecture be used for our version of Type III Architecture?

In attempting to answer this, let us take a look at a few of our alternate ways of translating the

* Figures 13-16, 18-26 and 28-29, submitted by the author in color, had to be reproduced in black and white, losing much detail that would be helpful to the reader. Since most of these illustrations have been published elsewhere in color, mention of colors in this paper has been retained for the use of those who may wish to look up the previous publications. The references are:

Clibbon, S. and Sachs, M.L.: Health Care Facilities: An Alternative to Bailiwick Planning in Patient Fostering Spaces. New Physician 18: 462-471, June 1969.

Clibbon, S. and Sachs, M.L.: Creating Consolidated Clinical Techniques Spaces for an Expanding Role in Health Care. Architectural Record 144: 105-112, February 1971.

Clibbon, S. and Sachs, M.L.: Industrial Techniques Spaces Make Clinical Spaces Work in Health Care Facilities. Architectural Record 151: 126-132, June 1972.

Reprints of these papers are available from Miss Clibbon at the Architectural Research Unit, 3401 Market Street, Philadelphia, Pa. 19104. --Editor

Patient Fostering Spaces, all shown to the same scale. First (Fig. 21), we have a rectilinear arrangement. The bathrooms are shown in yellow, the shower is shared between two, but everything else is individual. The vertical terminals are pink, the beds blue, the skylights white. Next, (Fig. 22) comes a portion of a sector of this kind of patient station arrangement. The only form of access for it is an aisle arrangement, the aisles running parallel to the exterior with an occasional cross-aisle. This arrangement must therefore be mitred at the corners.

The next arrangement (Fig. 23) we call our economy octagon. Bathrooms are in the middle, the shower shared by four, the other fixtures shared by two. The sector plan (Fig. 24) shows an aisle-access arrangement with a cross-aisle.

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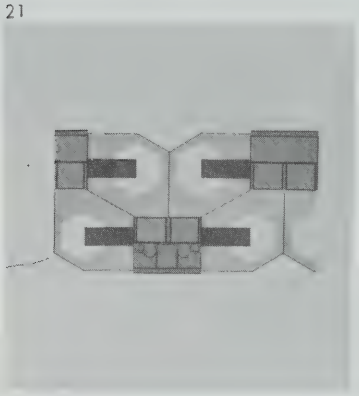

Fig. 21. PFS: Scheme E Patient Station, Plan

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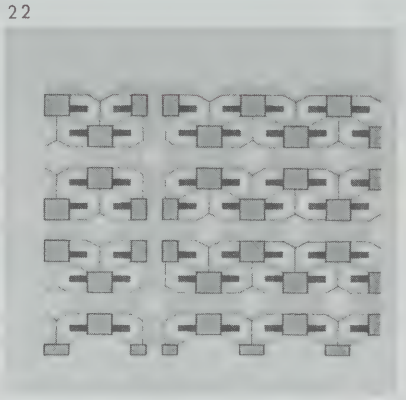

Fig. 22. PFS: Scheme E, Sector Plan

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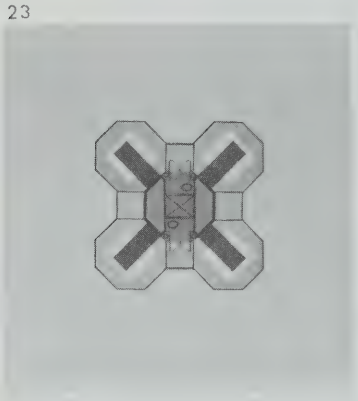

Fig. 23. PFS: Scheme G Patient Station, Plan

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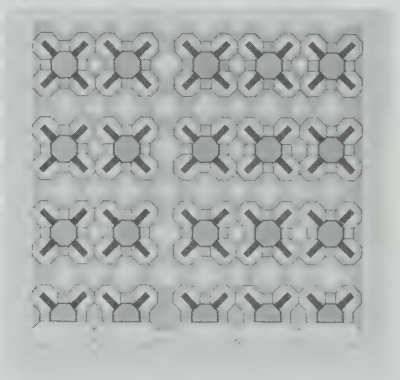

Fig. 24. PFS: Scheme G, Sector Plan, Parallel Access

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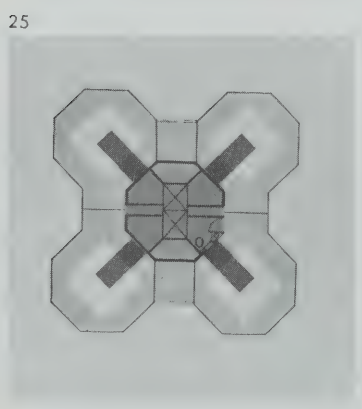

Fig. 25. PFS: Scheme F Patient Station, Plan

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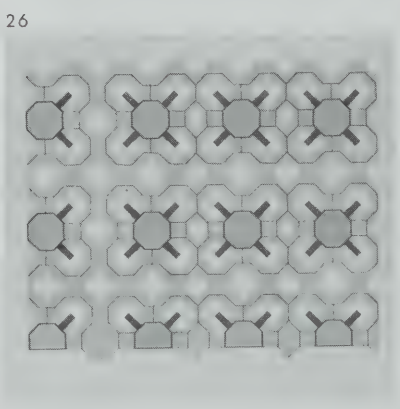


Fig. 26. PFS: Scheme F, Sector Plan

Because one can equally well have the aisles running in the opposite direction, this kind of patient station arrangement does not necessarily have to be mitred at the corners and is therefore easier to expand. The small spaces between each set of four beds can be used to increase the size of any of the adjacent rooms for additional equipment, rooming in, etc. The design of this version is dependent on the use of our Patient Handling System. With three major parts, plus accessories, the functions of many of pieces of equipment used for patients to lie on or travel on can be satisfied.

There are four methods of loading as well as countless alternate ways of satisfying the functions many of which can be incorporated in the patient station itself, leaving plenty of leeway to manufacturers to develop their own versions.

Next is a luxury octagon (Fig. 25) and its sector plan (Fig. 26). This is an example of what not to do because the beds are too widely spaced for companionship and the amount of space per bed is almost double that of the previous scheme.

Let us think of the components themselves and consider the patients' bathrooms, which are actually built into the terminals. The idea is to have access to the plumbing from the ITS space. In the first of these three examples the bathroom fixtures could be all accessible from the adjacent vertical man-enterable terminal, but this is not true of the other two examples where access has to be from the ITS below, with no other floor to the bathroom than that of the mould itself. Components such as conventional washbasins would not allow this objective to be achieved. Is a complete prefab bathroom considered an extra large component or is it not more likely to be considered a small model? The method of access alone would make it useless in Type II Architecture. Because of the way it interlocks in some versions with the vertical terminal and negotiates structural elements and housings for the spatial subdivision system, it may be peculiar to this variation of Type III Architecture. It has more in common with an aircraft toilet.

Secondly, I want to consider dimensional coordination. Fig. 27 is a race track convalescent unit I designed in Type II Architecture twelve years ago. It is obvious that while it can't be made to conform to a standard structural system or large module, dimensional coordination of the four-inch variety presents no problem.

The last two figures show details of the CCTS. Fig. 28 shows one version of the diaphram of physicians' offices with common exam rooms, which has rectilinear rooms and small square terminals. The rectangular terminals are for the toilets. Fig. 29 shows the central sterile zone, operating rooms in red, delivery rooms (which are the same) in orange. Surrounding them are labor, prep and recovery rooms. The point of division between suites can be decided from day to day. One kind of terminal is used

27

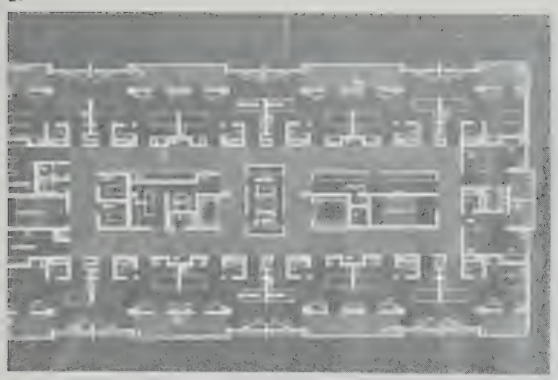


Fig. 27. Convalescent Building (Project): Plan, Second Floor

throughout this zone: the chamfered variant for ease of traffic, descending from the same square aperture. Two widths of panel are used to make all three sizes of terminals (except the chamfered corner) and all the partitions of all three zones of the entire CCTS ensemble; but the relationship between the two widths is geometric and crucial. If one width is the side of an isosceles right triangle, the other width is the hypotenuse.

How does one reconcile a ratio of one to .618 with a four-inch module? Assuming there is not much we can do in fudging the tolerances, even the lesser of the two must be 103 feet, if it is to consist of complete 4" modules, and the larger one would be 166 feet 8 inches, whereas what is needed is somewhere between 7 feet and 8 feet.

28

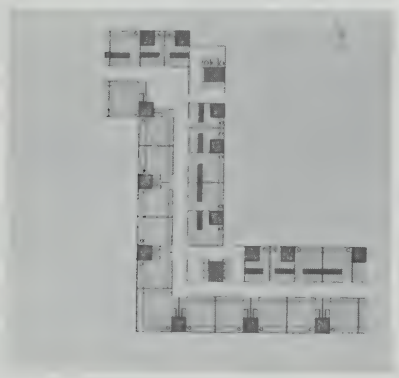
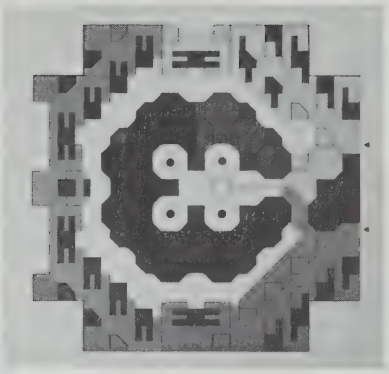


Fig. 28. CCTS: Diaphragm, Double-loaded

There is no reason to suppose that we cannot use a great array of standard components, whether they are dimensionally coordinated or not, for some aspects of this kind of architecture, but the approach is likely to be at least partially a model approach if a component system for Type II Architecture is available.

It is conceivable that some of the less sophisticated versions of Type III Architecture could entirely use a component system designed for Type II, and it is conceivable that some of the more sophisticated versions could use a component system if it were designed at the outset for both Type II and Type III Architecture. It is, however, questionable whether the breadth of Type III Architecture could be fully known before its design. Besides, someone might come up with Type IV Architecture! It seems more sensible to confine a system of components to a category of architecture, as long as we recognize what its limitations are. Because there are limitations, alternative systems must surely not be excluded.

29



Legend for Fig. 29

Fig. 29. CCTS: Sterile Zone, Phase 2

Even more worrisome, however, is the rigidity of the other aspect of systems building I mentioned at the beginning of this paper, the way information on what to provide is organized and presented. If we stick to existing administrative and physical organizational schemes, new designs are easily evaluated and compared with old ones, one like part with another like part, rather than one total system with a different total system. It is a matter of considerable practical importance and another pressure to perpetuate existing concepts. Behind all this is our inability to collect and handle all the needed data, and our willingness to let these limitations of systems approaches dictate what we will design and build in the future. We must be careful not to make the tail wag the horse.

Credits: Figures 2-9 and 11-12 were drawn by Roger Bridgman. Figures 13-16 appeared in The New Physician and Figures 17-20 in Architectural Record.

HOUSING PANEL

CHAIRMAN deMONCHAUX: I believe it would be valuable if the panel members could introduce themselves:

David Crane, USA
Colin Davidson, Canada
Jack Garnham Wright, UK
Burnham Kelly, USA
George Lawrence, UK
Riccardo Meregaglia, Italy
Neal Mitchell, USA
Jan van Ettinger, Jr., Holland
Pete Wilson, USA

CHAIRMAN deMONCHAUX: The panel met as a group during lunch and considered a variety of ways in which we might conduct this discussion. It came to no consensus. So, it has fallen on me to arbitrarily make a few suggestions.

First, most of the panel members have had an opportunity to say something prior to this in the course of the formal sessions of the conference. One or two of us have not had this opportunity, but in view of the pressures on our time it is my general intention not to specifically ask those who haven't spoken to say their pieces, but rather, should a question arise which they particularly feel relates to what they would have said, to give them a chance at that point in time to say so.

The second point is that the panel does consist of a resource of experiences, attitudes and techniques, and is primarily here to serve the questions and interests of the people at the conference. It would seem that for the greatest value for those attending the conference, the questions which panel members are asked should be basically ones in their areas of competence-- questions which relate to the techniques, the systematic methods, and the expertise in which the panel members are specifically experienced.

The third point is that the option does exist for us to break the discussion into smaller groups, should there be a series of issues which you feel would be better dealt with in smaller discussions. For the time being, however, I would like to start off.

The luxury, perhaps, which I have in starting this off is to say one or two things about definitions which I think may help our discussion.

We are concerned here with the way in which systematic consideration of housing can lead to a better result: systematic consideration of the design, of the delivery, and of the management and maintenance of housing.

There are three ways in which I look at the substance of housing. The first is as a set of expectations of the part of the users, the many individual users. The second is as a set of resources which either those users or others empowered by them provide for the provision of housing.

And the third stance is to look at housing as a set of devices, a particular pattern of frozen dollars which attempts to bridge the requirements posed by putting the expectations against the resources that are available.

My impression from listening to those whom I have spoken to, is that a great deal of the suggestions so far have been about this third aspect, the devices which are used and invested in to meet the housing expectations.

It does seem to me that we can also be properly discussing systematic ways of better understanding the expectation of those who are looking for housing, and more systematic ways of making available the resources, both in time and in money, for the provision of housing.

That finishes my remarks. I would like to begin with asking a couple of panel members who have not spoken to the entire group, if there is any particular question they would like to throw out; but failing that, ask for questions from the floor.

MR. WRIGHT: Well, perhaps just to say that what I think we have been talking about during the conference is the problem of the building industry in any country increasing its productivity in order to meet the massive need that is being expressed in that country, and the way it deploys is a product of the way the need is expressed.

I think that in each country the need is expressed in different ways, and it is the way in which it is expressed that tends to determine how successfully the needs are met. I think that one of the problems which arises when we are dealing with housing is that it is very much more difficult to express the need than it is with regard to school buildings or those other institutional buildings where it is possible for representatives of the community to make assumptions on behalf of the community.

In the field of housing, however, it is the individual man or woman or the individual family; and, therefore, there is an immediate difficulty in identifying what the product ought to be. A second difficulty, is being able to express it so that mass production can be deployed to meet the need.

CHAIRMAN deMONCHAUX: The discussion is open to questions.

VOICE: I just read a little statement by Don Stull that suggested that the innovation, especially in technology, usually comes from outside the field of vision of those interested in technology in their own fields of specialization.

An example might be the telephone-- invented by a man who had nothing to do with the current method of mass communication, which was the telegraph. The mobile home was developed by an industry that had nothing to do with housing, per se. Okay?

The case seems to be borne out now where new technologies are being introduced in the building industry by organizations having their center of attention away from building. Such organizations are the aerospace industry and the defense industry, and also General Motors, Westinghouse, Reynolds Aluminum and Alcan Aluminum, to name a few. These products are houses which will constitute the bulk of the market and will be sold in markets locally and internationally. And because of the previous success of the corporations like General Motors, etc., the potential of success of these particular products will be very high.

Now, my question is to any of the gentlemen on the panel: How can architects and engineers reconcile this product development of the non-aligned corporations with the seemingly small-scale operations and concerns that architects and engineers have-- that is, what we have been discussing here?

MR. WRIGHT: Well, I'm not sure whether I can answer that, but I can sort of talk around it a bit.

It may not be the case in America, though I would guess it is, but in Europe the demand for housing can only be met by materials that are in the massive industry and are also cheap. This tends to make it impossible for the enormous number of houses to be provided by any other means than the conventional materials that are available in great bulk.

This is not to say that the new materials can't be brought into the machine of production, and they are in fact being brought in. But they tend to come in through the expensive finishing parts of the building and become cheaper and cheaper until they are accepted into the main stream of materials supply.

The problem is to meet a massive demand and that can only be met by materials that are already in massive supply; and the commitment in supplying those materials is usually so great that it takes an awfully long while for it to be replaced by other materials.

I don't know whether that answers your question.

VOICE: Well, not really, because, well, if you take materials as a case in point, those organizations which seem to have the greatest ability to control the use of materials are non-architectural and non-engineering organizations. They are product, or rather material consumption producers: car manufacturers, aircraft manufacturers. In fact, there has been a lot of publicity, a lot of advertising that has gone on. Alcan Aluminum in Canada, for example, in collaboration with Canadian National Railways, is producing a housing unit that they are shipping in a market radius of about 2,000 miles.

Now, what I am suggesting is that these large-scale corporations which have the resources, will be the main distributors of housing in the next 20 or 30 years. I'm just wondering what we are going to do about it and what we can do about it,

whether we can subvert that activity, whether we can do something that will put us in a better position as planners and architects?

CHAIRMAN deMONCHAUX: I take it that is an open question as to whether this constitutes a threat or a benefit. And to whom?

VOICE: Yes. And to whom.

MR. KELLY: Let me say that twenty years ago I was saying the same thing and not trying to subvert it, but trying to encourage it. The day has not yet arrived when all this happens. Your question remains valid, however, and I guess that the thing to do is simply point out the fact that major corporations getting into the act increases the importance of having architects associated with the field, rather than decreases it; since hardly anyone in the field of architecture, including architectural students, has had any education or some opportunity to get practice in this kind of work. I guess everyone here would like to have that happen.

VOICE: Does that mean the architect?

MR. DAVIDSON: I tend to think that the premise that the corporations are going to get in is based on one crucial misapprehension, and that is that the big corporations are good at management.

I suspect that the building industry which is a very much more complex thing than the automobile industry, is characterized by having an industrial structure which is without any precedent anywhere else in the major production industries, and I think that the kind of management experience that the giant corporations have is irrelevant to penetrating into the building industries fully. It does not mean Alcan cannot make it with a few more homes, but the point still remains to understand the intricacies of the building industry and the kind of management processes which we don't have in the building industries. But I am reasonably sure the corporations don't have it. To use a kind of buzz word to describe this, the building industry is now beginning to be recognized as what is being called a multi-industry, and none of the business schools yet have any models for modeling multi-industries. They can model corporations and whatnot, but not multi-industries.

It seems to me, therefore, your question is based on what I describe as a false assumption, that the corporations will succeed in getting into the multi-industry situation. This still doesn't invalidate what Burnham Kelly has said. On the contrary, it gives a pointer where precisely we should be in the multi-industry.

MR. LAWRENCE: Could I raise a point? I think what we are talking about, what Burnham has been talking about, is a spin-off on the aerospace industry which has got one aim in life-- which is to put people on the moon or Mars, or wherever, and having got them there, support life there.

If they find in doing this that they have created too much material and there is another channel to use, then they look around; they make mobile homes or whatever, and I think this is entirely a good idea as long as it is controlled by the people who know the product that is wanted for the secondary purpose.

Now, there was a case, I believe in Britain a few years ago, when suddenly the shipbuilding industry fell on evil days. Nobody wanted ships. And there were a lot of very skilled people in the industry. So, they said, "Good, we will put them on to building," and they converted a number of shipyards, which were under-employed, into doing housing. They produced some jolly good housing, but the shipyards that were under-employed were perhaps not the best managed shipyards. The other ones were busy building ships, you see. [Laughter].

And when they went into housing, they produced some beautiful cabinet work, and people who got it were jolly lucky; but these firms very quickly went into liquidation [bankruptcy] because they couldn't compete within the market.

VOICE: Perhaps another way of saying the same thing is, for example, Boeing gets into the farming business. They will begin to experience some of the problems of the farmers. As corporations get into planning new towns, they will have to go back and examine town planning.

Now, whether this is done by hiring architects and planners, or whether they undergo a self-education, realizing some of their aspirations are more difficult to achieve than in fact they think, my general point is that sooner or later as different types of organizations move into a different area, they will have to learn that area, or at least something about it. They will bring new techniques and new disciplines with them, and hopefully educate those already in the housing business.

MR. CRANE: I would like to add something on the question of architectural roles. I think if you assume that systems-built housing eventually is going to be linked to some kind of delivery system involving major community development and land operations with respect to land components, you can identify at least three basic architectural roles, each of which should be played separately in an advocacy proceeding as in the practice of the law.

One is the product-line architect for the manufacturer. Another is the selector and coordinator for the sponsor, and the third is the user's architect for putting it in the ground. This assumes that we are going to more and more demand systems that are in themselves flexible enough to be fitted out to have particular requirements, both of the sponsor and of the user.

It is not necessarily so that the architect has to give up his involvement once we have rather universal systems building, but it is probably necessary that he make a commitment to which of these various advocacies he is going to fit into.

MR. van ETTINGER: I would like to add something to the discussion about the large corporations.

I do not agree with Colin Davidson at all. I do agree with this question which was raised about conventional materials as perhaps illustrating-- I will give you a figure: when you construct a house out of traditional, heavy materials, it is not costing more than 10¢ per pound of finished product. What will prevent the large corporations from coming in at this moment is that they are used to working in situations where the product is costing a dollar or more, that is, one to ten dollars per pound of finished product.

I do not agree with Colin Davidson in this way, that I think that large corporations could contribute to the building industry. At least if I compare that to my country, the average contractor in the Netherlands, which is apt to represent about 95% of all the contractors, do not make any profit from production. They only make profit-- if they do not go bankrupt-- from buying and selling things. They buy materials and they sell a finished product. They make their profit by buying and selling, and they lose on production and management of production. What the large corporations, or let's say the industrial enterprises, could teach to the building industry is how to make money out of production.

I have said once in Holland that the only way to make contracting firms efficient would be that the government would buy all the materials so as to prevent the contractors from making profits on the materials and losing part of it on production, and force them to become more efficient.

So, I think that the large corporation has to teach us a lot, but I am afraid that they will not come into the market because of that weight problem and because of the type of materials they are used to working with.

VOICE: May I just clarify the attitude I am bringing with this question? I am not seeing this as a duality problem, of having architects and engineers on the one hand doing their business, and large-scale corporations on the other hand coming into this thing and taking over the market as a completely separate business and making profits. I see this more as a question of control. I am raising my concern about it, that however we assume our roles as architects and planners, it is almost a certainty in the future-- and there are examples to prove this out-- that there is going to be an involvement of large-scale corporations in this industry. Cartainly from the view of technology,we don't develop technologies, we borrow them from elsewhere. From the point of view of materials, we haven't got materials. We are not-- what was the term yesterday-- vertical corporations? We are not vertical corporations, most of us.

The corporation, the large-scale corporation, through things like vertical integration, which may be a discredited phenomenon now, have internal savings and capacities and access to natural resources and materials. And they also have access to us. We are a resource.

We are going to be used in some way or another by the guys who can buy the large pieces of land and develop the most succinct products.

I am wondering about the architect's vision as a coordinator of wonderful programs, as an autonomous entity, or as a functionary of a large-scale corporation. There may be a new branch of industrial planning in housing, such as a Division of General Motors. There will be the quality of control, number one, on us; and number two, the quality of control brought through the level of the customer.

Now, what is he going to be faced with?

VOICE: I have a question. Do we want to speak about building systems, or do we want to speak about philosophy?

VOICE: They are inherent.

VOICE: We already have some history on this. It is small and it is difficult to extrapolate. We have Levitt and we have design of something in Puerto Rico, and we have Boise Cascade. We have Levittown, Long Island, and what has happened in connection with your fears for the future which can be learned from what has happened there and projected at least for five or ten years. We are not starting from limbo, it seems to me.

CHAIRMAN deMONCHAUX: I think there are two aspects to this. I understand that there will be a good deal of attention tomorrow that will be focused on the roles of the participants in the process. It does seem to me that we could valuably look not at roles, but at the product that is coming out of this, either in terms of what has happened, what the evaluation would be of some of the examples already given, or of ways in which those of us here have been instrumental or seen others being instrumental in changing the quality of the product, getting more value for the same investment, getting a higher performance.

So, insofar as we do have an opportunity tomorrow in a number of the seminars to look at roles, I think it might help if we stay for a moment with the product.

MR. DAVIDSON: Could I ask a question of Mr. Blachere? How does he evaluate the quality of the building system?

MR. BLACHERE: That is for tomorrow. [Laughter].

VOICE: We have a situation in Canada, for instance, where the industry at the present time is producing at the capability of 20% over demand. We need 200,000 units a year; the last figures were 240,000 a year for production. But the question is, what are they producing? They are producing houses that sell for $40,000 and apartments with two bedrooms at $22,000 and up; and this is not really where the real need in society lies.

We have the poor people who are the poorly housed, for whom the industry is not providing any answer. I know of one case of a large developer in Toronto who was pressured by government to change their production towards cheap housing. They did this under the Home Program, and the people went out and looked at the houses, and said, "Only one garage? No fireplace?" What had happened, the advertising industry had created an image in the minds of people that you need at least two garages and you need at least a fireplace.

So, even the poor people are not accepting the products now that the corporation produces at a reasonable price, and they can't get rid of them. In is quite a paradox as far as I can see in our society where the advertising plays such an important role. I don't know how to cope with it.

VOICE: I don't think that is quite true in the United States. I think in terms of cost, it is impossible by cost of money, the cost of technology and the cost of land to produce housing for low and moderate income people at the moment.

The choices, therefore, are threefold: either you buy or build a worse house generally not acceptable by FHA standards, or you subsidize it or you get a trickle-down house.

The advertising is not that irrelevant because a cheap, and what they call a junky house, is being built and being bought-- and that is the mobile home. The point is that the mobile home does not have to fulfill the standards that ordinary housing is required to fulfill, both in terms of the Federal Housing Agency and in terms of construction agencies.

The problem is there, but I think at the moment almost impossible to solve, except I think by either trickle-down houses, substandard houses, or by high subsidies.

VOICE: One thing we have found out is that these systems are just not competitive. They are in the market, they are subsidized by the government, or wage is subsidized by very large developers, and they have a market of 1,000 units a year. But, they themselves at this time are of the opinion that it costs them a little bit more. People are looking to the future and they say, if housing is going to be industrialized, they are going to stay in the game and learn and develop. That is the only reason they are in.

MR. MEREGAGLIA: I think I have an answer to your question. First of all, I know the operation in Toronto; and in my mind I don't think it is a system, it is just a prefabrication operation. They don't integrate it with mechanical work or finishing work at all. For that reason they are not competitive with conventional.

I am a constructor and I have fortunately many clients. If a client comes to me asking a bid for a project, I can offer both conventional and system. That is my answer to Colin's remark. With the system, I am sure without a doubt, I can offer better quality, and at least 15% less cost, provided he chooses my model.

If I have to adapt to his architect's design, I am stopped, because then I have to change all my organization, my machinery. But if the client accepts my model, it is cheaper by 15% with a much better quality. Why? Because of the skilled labor I have. Now, it is not so skilled to achieve a good quality in conventional; my machinery can do it.

MR. WRIGHT: A way of looking at this is to say that the building industry, in meeting man's demand, has developed the old type of mass production which is the standardization of the end product, and that is very fine; it meets the demand for a certain time. But when you run into resistance to your end product, you have to redeploy and you ought to be looking for mass production, new style. The method is to mass produce the parts in such a way that they can be assembled in many different ways to provide many different end products. All of the other production industries have gone through this hurdle and they can now make a massive number of different end products of a fairly small range of coordinated parts.

This goes for cars, for tractors, for furniture; and the building industry is working towards this in various parts of the world. It is strange how long it takes an industry as big as the building industry to learn the lessons that have already been learned in other production industries.

CHAIRMAN deMONCHAUX: But that to some extent does contradict your point about your model.

MR. WRIGHT: This is a step towards the development of building techniques deployed to meet massive demand.

VOICE: Could we ask this gentlemen on your left, sir?

CHAIRMAN deMONCHAUX: Mr. Meregaglia?

VOICE: Yes. Sir, could we ask you: I don't like your model, but I want to use your process; how can I do it? How much do I have to do, and how do you make the building for me to the design?

MR. MEREGAGLIA: The same as you go to General Motors and tell the president, change, please, just a little bit of something on the car.

VOICE: I don't want to change anything in your system, but I do want to change your model. Have I ruined your system?

MR. MEREGAGLIA: You want to change my product?

VOICE: Your product, but not your process.

MR. MEREGAGLIA: But with G.M. also, you can't change the model; even my process is a way to produce a model. If you'd like to change my model, it is finished, and I have to change the machinery and I have to redesign. Be careful; to design a building we design with an architect consultant, a designer; but we have our engineering staff. And we need from at least eight to nine months to design a building; and we do 1,000 working drawings for each building. If you'd like to change just a little piece, it is like changing a little piece in a car.

But when I set up all the organization for producing my model, I achieve a 15% or 20% reduction in cost; please don't change. [Laughter].

And let me have the responsibility for the product. Of course, we do research on what you

need beforehand. Maybe I know better than you know, theoretically, what your user or what you as a user like. Well, we do, or we try to do research that no architect did, never at least in Italy; maybe here it is different.

MR. WRIGHT: It is rather like in England where there is an organization called Marks & Spencer. They have learned how to mass produce shirts from a range of about nine standard parts, and by varying certain of these parts they can make shirts that fit 80% of the population.

Now, if you go to Marks & Spencer you can probably get a shirt that will more or less fit you. If you don't like that shirt, you can go get one made specifically for you, but it costs you a lot more. The effect of this standardization is that a lot of people are fairly well provided with shirts; and people who want something a bit different and a bit more fitting to their own requirements have to pay more, and that is all. They are not prevented from getting them; it is just that the market tends to govern how.

VOICE: Let me direct this discussion to programming of standards. I was struck yesterday with the fact that Professors Kelly, Crane and Mitchell all made in their different ways reference to where the programs changed during the course of a development-- the Breakthrough project that Dave was talking about, in which the larger apartments got dwindled down and the small apartments got increased in number because there was more profit; and Mr. Mitchell made one of his innumerable, humorous stories about Vermont and the wood-burning fire. The lesson I think we should have gotten was that the standards were much higher and would have been satisfactory for some kind of housing. Dean Kelly in his morning discussion made a more general observation about the fact that the standards were simply not supportable, not buildable, and so nothing was done.

So, I wonder if there is any-- I don't know to whom to direct the question-- any solution underway, or study being made with respect to, by public and/or private sources, to make some housing analogy to a Vespa motorscooter. The Vespa was enormously valuable in Europe several years back, so that everybody could afford transportation in the form of little cycles. It seems there is a vast amount of low-income housing that simply isn't being produced because government standards are too high perhaps, or that there is not enough profit for industry. That seems to be a recurring theme. I wonder if there is any comment on that?

CHAIRMAN deMONCHAUX: I wonder if the operation of both, if I could turn to either our English or our Scottish representative to comment on the operation of a dual influence on housing, the Parker-Morris standards as statutory requirements, and the housing cost yardstick as a selling device; and the interaction of these? By standards, here for a moment I am using the definition of the publicly agreed definition of what is a minimum acceptable environment as distinct from any informal set of standards.

MR. LAWRENCE: I think I would like to come in on that, if I may. In spite of what is said on this, the amount of space between the minimum standards which we will call the threshold and the maximum cost which we will call the ceiling-- why you don't have a "floor" and a "ceiling" I don't know, it is always the threshold and the ceiling-- but between these two there is a very narrow space. It means that people who are concerned with the bank of housing have got to be extremely clever if they are going to exploit the amount of over-room that you have got to work with in this space.

In England the expertise on this on the whole is held by professional people in governmental bodies and they in fact are producing a number of models which gives you the best buy within this somewhat narrow limit.

The interesting thing is that the private sector, because they are catering for a different market on the whole, have to comply with Parker-Morris, because this is something which helps them to sell their product; but regardless of the cost, the people in the private sector use a lower standard. They take the absolute minimum Parker-Morris standards, whereas, in the public sector they seem to be able to get a bit more space, a bit better finish for the houses they do. The interesting thing here is that if you take away the prop of government subsidy for housing, then it may really mean that the demand, which is what people are prepared to pay for a house, is for perhaps not quite such a good article. This prop is being removed at the moment in England, and if this is so, then people dealing with housing will have to look for some other product.

If we do discuss this further, my outfit in fact has been making a study of what we call the expandable house of the unfinished house. So, if a couple buys a house when they haven't got much money and possibly not a very large family, they can hope for a better day when they can build a bit more on to it. Or if the chap is handy with his hands, he can in fact do a certain amount of work himself. I think this is perhaps not for discussion in a public forum, but I thought perhaps it might be a helpful interjection.

MR. WRIGHT: I would like to add a relatively simplistic view that if as you say, the government is setting a standard which is too high, the government should respond to political pressure; and if the buyers want to reduce the standard, they can see that the government does that. But you then have to consider, what do you mean by standards?

Do you mean standards of quality, which is one thing; or do you mean standards that affect health and safety, which is another thing?

And one of the problems in the whole field is the governments which are crudely informed; and if you need better information, you need more research. One of the things that is lacking in the building industry is money spent on research.

This is one of the reasons why new materials don't get into the building industry first, because their development is very expensive. In a way the building industry gains from somebody else's spending money on research and development activities. I am all for increasing the amount of money that is spent on building research. This would be one of the keys to you being able to determine what the standard really ought to be.

VOICE: I would like to raise a couple of issues; one of them a bit philosophical, and the other quite a bit more pragmatic.

One of the things that I just don't want to hear any more of is the business of how do you build cheaper housing for lower and moderate income people. The product we are producing right now for those groups isn't hitting on too much, to put it in the vernacular. On top of that it seems to me, if anything, that housing should be of a higher standard and quality than anything else, because so much of life revolves around the unit. Think of how much time per year you spend in your own unit, and contrast it with how much time a guy spends in his house who doesn't have money to go any place else.

So, this business of talking about continually lowering standards seems to me not to really be hitting the essential point.

The other thing I am a bit concerned about is we have been sitting here talking about trying to become more whole in our perspective of industry and wondering why we are lagging behind everybody. But I don't think there is any real attention paid to why we are in a bind right now. We are all here knocking ourselves out trying to figure out how to save three or four cents on some element of building construction, and I am not sure what the end of that is going to be, anyway. In fact, we perhaps ought to be looking a little bit at what brings those costs up so high and perhaps get a little more active politically, whatever that means; because in America at least, for the 10% you can save in building costs, if you can get that constant interest payment down 1%, you have achieved that 10% savings anyway. Maybe what we ought to be doing is trying to figure out a way of trying to get the cost of that money down and upgrade the product.

I have seen a lot of processes over the last couple of days, but I think we have got to be a little bit harder about what kind of profit we are coming up with.

MR. van ETTINGER: I very much like your philosophical point of view, but let's forget for a moment the question of standards. I, to a large extent, agree with you that millionaires could live on lower standards than poor people, but I think we can learn two lessons from the automobile. One is that they have recognized that a car of $2,000 is not one problem of $2,000, but it is something like 20,000 problems of 10¢ or perhaps even 200,000 problems of 1¢.

VOICE: But that is not what I said.

MR. van ETTINGER: In the automobile industry a quarter of a cent is revolution. They recognized that already back in 1928, and we haven't recognized that today; and that is one of the reasons the building industry is behind. May I just finish?

VOICE: Let me clarify my statement so I am not misunderstood. Sure, that may be true, but I am sure they are not looking around for how to save two or three cents when somewhere there is an unresolved problem of $10 per part. I am saying that relatively speaking we are bothering with the small stuff and we are getting hit over the head with much more significant costs.

MR. vanETTINGER: I'll come back to that question of financing later. I agree with you there, but let's stick for a moment to the cost of the building as such. Only when we start to recognize that also house building is perhaps 100, 200, or 300 thousand problems of a couple of cents, are we coming anywhere near making a cheaper product. That is one side, and I think there is something more basic which we can learn from the car industry.

What happens in house building? You have an architect who has an idea in his mind how somebody should live, and he makes a design accordingly. Then you start to calculate what the costs are, and with whatever kind of subsidies you have you cannot finance it. And then we start a cost reduction which ends up by breaking up the whole idea of the architect, which is too costly anyhow. What has the car industry always done? They have said that at a certain moment there seems to be a hole in the market for a $2,000 car. Now, how can I create circumstances for that "$2,000 market" in housing with the kinds of potential clients there are? I have seen a good deal of revolution in thinking that we would not reduce costs, but we would maximize values to the amount which is available.

Now, coming to the question of finance. If you raise the interest rate 1%, it is the same as a 10% increase in cost, which is quite an increase. We have been faced very much with that problem in the Netherlands. In a period of ten years the investment rate for social housing went up from 4% to 8-1/2%. What are you going to do?

We are discussing today why we can't come to a system in which savings are generated to a special fund for housing in such a way that there would only be a nominal interest paid to those who bring in their money, and in which their money would be safeguarded against inflation, because behind the money would be the investment in housing. This would bring you to the situation where in the first year you can calculate on a 4% interest basis, because you have covered your inflation in another way. Even that 4% is a rather good benefit, in my country at least, especially if you question the situation of why do all the people invest their money in bonds and these bonds are not protected against inflation; and they give only 5%. I agree with you that if we want to finance housing on the basis of market rates of interest and at the other hand increase rates based on inflation, we will never solve the problem.

MR. MITCHELL: To raise points on both of your questions, one of the things we found was space performance for low and middle and upper were approximately the same. In other words, I can't distinguish the difference among the three. What we did find, however, was that the finish requirements of the three varied, and that is where we felt there was an opportunity to play. As we look at what is going on in this country, people tend to play with space and not with finishes. They end up cutting down the amount of space and running into a disaster.

Now, if you turn around and take the basic envelope of the house and say that is that, or of the dwellings and say that is required independent of who is going to live in them, then you begin to make some significant savings, and also some great flexibility.

For instance, one of the things that we tried was to take tiling and to put it on the floor in a single sheet; but to make it a one-year sheet. It snapped in on the coating with the label underneath. And once the person lived in it for a year, they would start changing; they unsnapped the worn out sheet of flooring and brought it down to trade it in, and get a new sheet that was a five-year sheet. The sheet comes when you buy the house, and you buy both packages-- you buy the remodeling in the initial package. But if the manufacturer begins by making a ten-year sheet that was equivalent to the five- and one-year sheets, he wouldn't make an interior product to give the flexibility of change to the people moving in; and we felt these were things that gave us leverage.

Another thing was the idea of taking the heating elements, and instead of selling energy at a meter, selling processed energy. Turn around and take the entire core package of the house and let the electric company sell or provide processed energy for the low-income families, in which case the electric company owns the core of the house. And that becomes a depreciated item, much the same way they depreciate their cars. That saves about 33% of the initial cost of construction in the hardware package and provides a depreciating item for the manufacturer or for the utility industry down the end of the road.

So, everybody seems to make out well; but that, too, gives you flexibility of playing with finishes inside the house, which we consider to be important, and the thing that should be attacked when one starts looking at savings in terms of cost.

So, I think that the argument is not one of size, which everybody has used, but one of finishes, and ways in which one can innovate financing the finishes.

MR. KELLY: I entirely agree.

You go into a little house in Denmark which has one faucet in the bathroom which can go into the sink or into the tub; and how many times do you have to run water into a sink and tub at the same time? This is just ingenuous. It is a small reduction, but it is important.

One more comment. If we would only admit that a great deal of housing is not and will not constitute a private enterprise market, and start looking at it rationally. It seems to me that we have to talk about what makes a reasonable service standard and not keep talking about it as though we could make money on it.

MR. CRANE: I would like to ask Neal Mitchell and possibly Burn Kelly if you have ever participated in any serious discussions with the banking industry on the possibilities of differential mortgage periods and interest rates for the different components?

MR. MITCHELL: My answer is, yes, with FHA. We proposed to FHA that they consider finances, multiple-phase financing on the house and parts of the house, dealing with people living on food stamps who could afford something like $10. As a matter of fact, this came directly out of a study that was being done in Bolivar County, Mississippi. And it got preliminary approval through FHA-- their banking section, for financing part of the house. And then somebody came in from higher up and pointed out that when the newspapers got hold of the fact that the government was putting people in houses with outside privies, that this would embarrass the President; and everything stopped.

And I think the same thing happened in Vermont, with the governor who is still governor. We proposed in the depressed area of northern Vermont that we build houses with wood-burning stoves, and talked with several financial institutions; and everybody went to a point until somebody panicked: What would happen when the newspapers picked up the fact that the government was building houses with, as they said, substandard living conditions, if you have wood-burning pot-bellied stoves-- and it starts with the press coverage.

MR. CRANE: How about Wall Street; did you have those kinds of discussions with the bankers?

MR. MITCHELL: Yes. The guy looked at me and said I was out of my mind.

MR. KELLY: I talked with bankers on a theoretical level and they would be delighted if they had a differential form of mortgage, if they could separate the real estate angle out. So, I'm quite interested in getting a study started on real estate. It seems quite odd: something like an atomic plant with all the heavy equipment and everything else is considered personal property, and taxed on that base; yet if you come in with a ten-dollar lighting fixture and screw it into your house, it is real estate, and you are taxed on that base.

It seems to me we could make a reasonable case for the kind of thing Neal has been talking about and many others have been talking about for some kind of a package for utility services within a house which is taxed as personal property. You depreciate it and that way you sell it back again, and you move it in and out and whatnot; and you might not only thereby be able to adjust your real estate tax on the property.

If you could rule for some kind of a modular housing system in which only their elevator stacks were real estate and that all the units attached on them were personal property, like mobile homes, and financed on that basis... I think we have to do a lot of innovation. You are quite right.

VOICE: We act like it is real innovation to do what every major corporation has done with differential depreciation rates for its institutions. The IRS says you can depreciate heating and the whole bit. The thing we have got to get into is the area where the ballgame is being played.

CHAIRMAN deMONCHAUX: The discussion seems to be on this difference between the cost and the price and the way in which the price can be manipulated in relation to the consumers' resources, as distinct from the cost of actually providing a reasonable environment.

There is one example which I have recently become aware of that might be of interest here and that is the potential of quasi-public bodies to, because of the ambiguity of their status, to break rules and get away with it. The political potential of a body which is half in the public and half in the private arena seems to me to have a good deal of untapped resources to it. The instance that comes to mind, in fact is a public body, one of the development corporations of an English new town which is going out and competing in the private housing market by not selling to the man who buys his house, the land, but only selling him the house, and leasing him the land for at least ten years down the line; giving him the option of buying the land as well.

Now, it can comfortably absorb this in its dealings as conceivably could the New York State Urban Development Corporation if it also looked at this kind of thing. It does seem to me that there is a realm here for exploration by the quasi-public bodies of how to, using the IRS regulations, using any others, get around the price of housing as distinct from the cost.

MR. MEREGAGLIA: We have to realize that the only way is to completely change the approach to the market. First of all, up to now the market has been and still is fragmented. So, we have to aggregate the market where up to now a certain client has a certain piece of land and he has a certain architect who is designing a certain design; and then they offer bids from constructors who do what they can, and adapt themselves to the design. It is not the best way to reduce costs.

The best way, the only way to reduce costs is like Jan stated: we have in the building many thousands of items and we have to cut down by one cent on each item. But we have to handle as a producer the design and program and scheduling and only in this way can we drastically reduce costs.

To handle a design doesn't mean to lower the architect's position. It means to put the architect in the same position as a designer in the car industry or in the shoe industry-- somebody who is giving his best for the design of the product, but collaborating with the producer.

We call it in Europe the menage a trois. It is the combination of the husband, wife, and a friend of the wife. And we have a client, producer, and architect; the architect who is not in the economical family of the producer and the client. If we put the producer and the architect together in collaboration, we can cut down costs drastically.

MR. van ETTINGER: Can I say something about this aggregation of the market? I would like to add to Riccardo's remarks that, based on the experience in my country, this only works when the government takes an active role. We went through a period of about four years, '63 to '67, in which the government used its influence in the housing market to aggregate demand. Let's say one of the most striking examples we as consultants were confronted with is that at a certain moment, one type of one-family house was built in a series of 1,000 in thirteen different municipal authorities, on twenty different building plots; and this shows what is possible in the organization of the market if the government takes an active role. The active role the government was taking at that moment was to say, "if we are to finance the housing," -- which is about 40% in my country-- "we will only give the contingencies if they fulfill certain requirements." The requirements have to do with efficiencies and labor savings, and have to do with the preparation of the plan; and even went so far that the contractor had to be involved in the preparation of the project-- although that is against the law of my country because the law states that public housing should be publicly tendered. This is something which is lacking in the U.S.A., that the government does not formally have the power to percentage-wise extend, as my government has, and secondly, does not seem to be willing to take that power.

MR. DAVIDSON: I don't agree with the people who have just been saying we have got to wait until Uncle Sam or someone else aggregates the market.

It seems to me it is an extremely unsystematic approach to the system building problem to wait for that to happen. I say this in full consciousness of what I am saying, because I would refer, without going into detail, to an experience that I lived through in Great Britain in which a group of people and myself developed a particular method of building; taking the market as it was in England, working on the basis of studying the probabilities and improbabilities inherent in that market, and offering a product through a series of mechanisms precisely adjusted to the market.

I think that we can say that we succeeded to a certain extent because we improved quality and reduced costs by about 5%. It may not be very much, but I happen to think it is rather important, even 5%. So, I take issue very strongly with people who tend to shelter themselves behind the fact that there are certain things we cannot do.

We have got to take a systems approach, as I see it, which means taking cognizance of the situation as it is and then working on it in the best possible way,which does not mean waiting for it to change absolutely.

MR. van ETTINGER: Then I have to add something. Colin, I completely agree with you; but I didn't tell what happened before the government made that regulation.

Before that time we had been doing a lot of experiments in this field, and we had a lot of facts to prove that this was where you should work. We convinced our government that they should make such a regulation; and I completely agree with Colin that we cannot stay inactive and wait until Uncle Sam makes the big decision; we should together go the hell out and convince him that he should do that.

MR. BLACHERE: Yesterday I gave an example of the intervention of the French government in multi-story housing; but in other sectors something happens without intervention from the government. In single-family housing where some industries and contractors launch systems by normal selling, we recently saw builders gathering to launch, not systems, but standardization of components like elevators and windows. I think many, many people, organizations, institutions, etc. are able to launch systems. It can be government or it can be architects or builders, or anyone who is able to industrialize.

MR. WRIGHT: Well, I think it is obvious to say that the more the client can organize the demand into a large, rolling program, the better the opportunity is for the building industry to develop great efficiency and reduce costs in providing the goods. And while I agree with you, don't wait around for somebody to do it for you, you obviously can do it much better if you have government getting organized and taking a part in this kind of thing.

I would like to add one more thing, that in the building industry the design function has been separated from the production function; and I think given a rolling program, that the building industry still has got to develop full efficiency. It is rather interesting if you pick out the methods that have increased building productivity in Europe-- I won't use the word "systems"-- you will find they are always methods where the design and production functions have been together by some means or other, fair or foul.

MR. MEREGAGLIA: In answer to Colin-- don't go, Colin, please. [Laughter].

MR. DAVIDSON: I am getting in a fighting position. [Laughter].

MR. MEREGAGLIA: To aggregate the market doesn't mean to wait for somebody like Uncle Sam to aggregate the market. My solution is to be at the same time an industrialized producer and developer. So I am in the private market because I don't have any Uncle Sam, any Italian Uncle Sam helping me. I am trying to help myself.

I agree with you if you are speaking about low-income housing. I am a developer. I am profit motivated. I am more interested in speculating on land, not in producing buildings. So I will very probably-- and I think statistics are 100% for this answer-- address myself not to the low-income market, but at least to the middle-league market. If you try to solve the problem in your country of low-income housing, I think there is some sort of Uncle Sam intervention necessary; otherwise profit-motivated people have difficulty in this type of market.

VOICE: We have been talking about cost, and it appears to me that we always talk about the initial cost; whereas, we should really be talking about the total cost, which includes also the financing. At the present interest rates, at least in Canada, if you can save 10¢ on the product, you save 20¢ on the financing.

MR. CRANE: I would like to add a small polemic note to this entire question of market aggregation. The discussion since my friend Davidson's statement a little while ago, has drifted back into rather narrow criteria from what we are really trying to achieve. It misses a point in terms of our search for a quality environment.

Now, it seems to me in industrialized housing, we have a basic issue of quantity and economies of scale of production. Against this we have to trade off all the other values which the consumer and the community will demand of decent housing environments at a community scale. Then if we are going to go into market aggregation, we must not suppose that that is creating an opportunity for 5,000 Tracoba or 5,000 Wates or whatever units, in one place. This is, unless Tracoba or Wates develops an extremely flexible product line capable of building in virtually every building type with a great variety in terms of design quality. You have to think in terms of market aggregation both in the private sector and through government intervention, in which we are able to achieve the necessary quantity through some reasonable regional concentration, on non-contiguous sites and in a manner that will allow us to put together communities with considerable diversity, considerable attention to the community facilities and all the other things.

My office had a very brief and interesting experience working on a small study of how they could go about optimizing opportunities for a series of four or five subsidiary companies that they own. Each was in one way or another involved in a manufactured house. The parent company was interested in putting together a consortium so they could take advantage of the different qualities of each of the different systems, and each of the different building types in the subsidiary companies; but not have each company operating independently in trying to achieve its scale in single projects of too many repetitive elements. We went through an exercise of developing various kinds of environmental models and notions of regional concentration. We didn't get very deeply into the issues of plant location and all of that, but the presumption would be that these different enterprises would be orchestrated in such a way that we could build communities and not houses.

VOICE: I think the basis thing is missing, and we end up talking about concentrating on costs and processes. I think the basic issue for architects and designers is to know more about the design process and design considerations. In reference to the first question, "Where does the architect stand in consideration of industrialization of the large scale of housing?" He has to consider the different aspects of the design, and he can contribute to the structure.

VOICE: I think the basic question, coming back to Mr. Crane's remarks, is the question of how you will measure flexibility. The architect's specialty is to speak about flexibility, but he doesn't know what is flexible. That is my point of view. If you can answer how we measure the flexibility in terms of cost and of productivity, maybe we can accept it.

MR. CRANE: Do you want my definition of flexibility?

VOICE: Yes, you speak all the time about flexibility. To measure the flexibility in terms of costs, in terms of economics, in terms of production; how did you measure it?

MR. CRANE: Well, I assume that a technology is either a process or a device, or both, by which we can make environments. And that technology gives us the optimum in terms of the elements with which we design the environments we choose; while at the same time it can achieve other scales of production as required to meet the demands of the market it has created for optimum flexibility. The system which depends upon structural artifacts, limitations of shape, preconceived dimensions, preconceived materials to the highest degree, is the least flexible in terms of this one kind of flexibility which is giving us the tools that we need to make quality environments.

Now, there are various other kinds of flexibilities. Neal Mitchell spoke about a number of them yesterday in terms of the flexibility with respect to variation, substitutions, or changes after use.

There are various other kinds of flexibilities that we could speak about as well, but the most important one I think for this discussion is the issue of, to what extent is technology a product preconceived at a scale which is not a workable one in terms of the basic response to a particular need, to particular environmental qualities?

MR. van ETTINGER: I think two concepts tend to get mixed up here; the concept of flexibility, and the concept of differentiation of variety. I think you are talking more about the differentiation of variety, and I completely agree with you that you need that to make a viable community.

I would like to add the following to this: there are, of course, very rigid systems, as rigid as our friend Riccardo has been describing, but there are also systems which are in your terms more and more flexible.

We are now experimenting in the Netherlands with an in-situ concrete system which is based on half-tunnels. This is the French Outinord system, in which we have basically one production flow, combined dwellings of different widths, different depths, different numbers of levels, and a different internal layout and relationship, all in one block.

There is another example in our row houses to give an indication as to cost. Our idea is that this kind of flexibility or variation, as described above, is costing about 10% more than no variation whatsoever. But the interesting thing is that a well-organized production process with variation is distinctly cheaper than a badly organized process with only one model.

So, if we get ourselves organized, we can pay for the kind of variation for which you are looking.

MR. MEREGAGLIA: I would like to claify a misunderstanding. Everyone of us knows a lot of books describing systems. I am representing one of the systems. I would like to affirm that the system in SURGE doesn't exist. "System" can be just a label put in front to sell an organization. It is not true that my system, the Balency, is using the labor in such a way; it is absolutely false. We do everything with our organization, everything we agree in collaboration with the architect according to the local market, according to the kind of building it is or the kind of community for which we have to build.

It is not rigid. We have to adapt ourselves to the situation. It is not true that we use only concrete. It is true that we try to use the most economical materials at the location. We use concrete, lumber, everything; it is just an organization of people who are supposed to have some brains and with a collaborating engineer to implement a type of building.

If you as architects find a Balency system licensee telling you they can't change, it is just because they are looking for the most economical solution. It is not true, it is just an excuse.

CHAIRMAN deMONCHAUX: We did have here a question on this other topic of user needs and user requirements which the panel didn't touch on. Would any panel member want to have a go at that?

MR. MITCHELL: I want to speak to the gentleman from Carnegie Tech who said we should be here talking about the process. I think it might be worthwhile to take a couple of minutes to find out about the process of putting some buildings on the ground.

I have a good friend-- I mean it's not me, it is a friend, because I wouldn't do anything like this--. Let me describe the process he went through, and you tell me where you fit in and how your system fits in, okay? This is the way the world operates today.

We went out and found a piece of land somewhere near Boston, and we couldn't afford to put any money down for the land. So, we went to the farmer who owned the land, and made an arrangement whereby he gave us a lease or a commitment that we could use the land. His price for the land, when we got all through, was $100 a house by the time we put all the houses on it.

So, we made an agreement with him that we would give him $300 a house, if he would give us the use of the land for the next two years. What we did was to increase his profit without, in effect, paying any money ourselves. So, the commitment of the land came to us for no money.

We didn't have any money. We were kind of

poor and figured in order to get an approval, we would have to go to the government and get FHA approval. We then looked around for an architect. And today architects are pretty hard up. So the chances are you can get an architect to do a sketch of how the land should be developed, for nothing, on the stipulation that he is going to get the job. When he does it that way, he doesn't do it too carefully-- just enough to get the job.

We took that sketch to the government and got an initial commitment on the land. Then we went back to the architect with the initial commitment-- we haven't spent a penny of money yet-- and said, "it looks like it is going to be all right, if you do a perspective of what the houses look like, and if you want the job, you have it." He draws up a picture. We still haven't paid him anything. Deciding the picture was worth something, we were going to get the project financed.

So, we took the picture to a group of people who had money and sold them the depreciation on the project. This gave us the money to start paying ourselves-- not the architect, mind you, ourselves, because we really don't care about the architect.

Then we turned around and looked at the architect-- having found out that the fee from FHA was something like 7%-- and we pointed out to the architect that we didn't want too good a job and that there were a couple of other people angling for the job. We said we were willing to give him 5% providing he gave us 2. Okay?

Then another guy came along and offered to do it for us, and he had the stamp and everything, and he offered to do it for nothing, because he had a standard box of plans already approved by the government. We eventually took his plans because you see, by taking the ones already approved, we know that the project would be approved. He agreed to take for his fee, 3%, instead of the 7% out of retainage at the end of the project.

Now, this particular architect is available to all of you, you know. You can go to him; and most of the large developers in Boston use him. We tried to compete against him and couldn't. Okay? But he was willing to take his 3% out of the retainage at the end of the job. That meant more for us.

We took these plans and put new title blocks on them, because that is all they required was new title blocks, and the FHA approved the project; and when it approved the project it gave us $1,000 for each of the houses.

We owed the farmer $300 a house, which meant we had a profit of $700 per house; plus we were paying only 3% to the architect.

Now, I listen to you and you tell me I ought to hire a systems architect, and you tell me I should be involved in the process. And I say, you want me to lose money; by the systems designer you are asking me to pay a guy to sit down and do some work, you see; and the answer is, if I am a business man, it is insane. Why should I?

And that, my friend, is part of the problem you face in terms of the lowering of standards, lowering of quality-- the fact that I can get in with no money down, and I can get out making a hell of a lot, and if I use something that is old and bad and it has been used before, fine. And if I can back the architect into a corner-- and they are around and you can back them into corners-- that begins to raise some very fundamental questions as to how do you reorganize the whole thing so that you start producing quality; because the system is built to pay off on non-quality performance. Now, change that and we can start talking about systems.

VOICE: I think the basic thing is that architects have been exploited by all the people in the building industry, and the reason he was exploited is because he wasn't organized. And if you look at the whole profession, which has been the aim of this conference, it would be better to see the division instead of, as housing, education and health care, it would have been better to look at the process in a sense of design process, construction process, and management process, which makes more sense to understand the whole process of systems approach.

To your questions, how architects can help, I think the reason the architect is becoming obsolete is that he has stopped understanding; so people think that the architect is nothing more than a person who can come and make a few changes here and there to make a building beautiful. What he has to do is to understand the rules, and understand the client for whom he is working. The thing he can do is improve his design methods and understand his design process.

MR. MITCHELL: If I am building a building in Boston, I really don't have to deal with the client; I deal with the government agency which gives me approval.

I don't have to deal with any of the questions that you raise, and you have given me no reason to hire the architect. If I am actually involved in building buildings, the way the process is set up now, I don't have to consider any of the things that you have stated. All I have to do is get a set of plans approved that are reasonable, standard, and conform to FHA regulations. As a matter of fact, the closer and tighter they conform the more preferable; and if you want approval, you get something that is built, whether it is good or bad or indifferent. You get approval in that framework. Now tell me how we start talking about the process?

VOICE: Well, I was going to hazard the general observation and see if I can get some arguments, recognizing that taking averages and making generalizations are both dangerous, and taking the words in the title of this conference, I would hazard the observation that with regard to housing, the process has improved and and the product has not. Is there anyone who can argue with that? No argument?

CHAIRMAN deMONCHAUX: Yes, I'm sorry, there is an argument over here.

VOICE: Finish first.

VOICE: What I was going to add is that perhaps next year's conference should be product, not process. [Laughter].

VOICE: Nobody seems to be able to say what is wanted in this country in the way of housing. In any event, not in a form which is useful for the government or for industry to be able to respond to. And we talk idly about quality and flexibility; and as we heard yesterday, quality has no meaning by itself, only in relationship to the economy of production.

What is quality is fitness for purpose. Is it large-sized rooms? Is it smooth finishes, or is it flexibility? Only those people seem to be able to say what is wanted, who are salesmen, or those who are producing themselves. We heard that Mr. Meregaglia asked all the architects in Italy what kind of house is wanted, and nobody could tell him. So, he had to go out and find out himself; and he could do it only in relationship to his economy of production. Therefore, he knows what you can afford, or what his clients can afford. So that is why he said it sounds a little arrogant, but that he knows what you want better than you, because he knows what you can afford using the process that he can provide.

The reason why we cannot say what is wanted is because we know nothing about the economy of production. Until the design professionals learn how they are done and what is the price of things, they will never be able to say what is wanted, either to government or to industry. Therefore, they are not able to respond to the needs.

MR. van ETTINGER: That is only one side of the question. I quite agree with you that architects by tradition are perhaps trained either in aesthetics or in structure or constructural problems, but not in problems of production. That is something which was always highly striking for me as a mechanical engineer. I started on the first day of mechanical engineering with what kind of production processes are there, what kind of equipment exists, when you can apply it, what the consequences are, the investment consequences, and all that. This is basically lacking in architecture. But, I say that it is rather one-sided because even though the architect doesn't know about the production and cost consequences of his designs, he is even more seriously lacking in knowing about people.

The architect makes a design which he determines is how people should live. But, the architect is not going out in the field any more today to study how people are really lving, what they want and what their needs are. I think on that problem the architects should and could help us, otherwise we will have to employ psychologists, and we don't need them to find out what things are costing, because our friends the producers already know.

VOICE: I would like to pick up on Mr. van Ettinger's point and paraphrase, not really paraphrase, but use in a different context something that the speaker this afternoon mentioned when

she discarded the terms "serve in space" and went to "servant in space". I think I can paraphrase that slightly when we start talking about what we know about production as opposed to what we know about how people really live. It seems to me that, how people live has become a servant to production rather than production being associated with how people live. One of the most encouraging signs so far, is the frank realization that perhaps we have started to get a grasp on the hardware of producing buildings; but as yet we aren't responding to the way in which people live now.

VOICE: I would like to go back to Mr. Mitchell's point, because I think it is important. We as a group can sit and talk about quality and everything else for a great period of time and possibly produce a little of it ourselves. For every bit of quality we produce, somebody else is going to produce three or four or five times as much in terms of garbage.

I would like to ask how Mr. Mitchell thinks we might go beyond this point. How might we get quality control so one can't go ahead and build trash simply in the name of profit?

CHAIRMAN deMONCHAUX: I think that is a fair question. Neal?

MR. MITCHELL: I don't know the answer myself, but I think it is the biggest problem we face. We are all very moral and someone else isn't; at least that is what we would like to think.

MR. WRIGHT: What stands out in my view as an observer is the problem you talk about of getting the building approved. Now, it seems to me if you can get the authority that does the approving to take a reasonable view about standards, and express the view on behalf of the public, what the standards ought to be, you would be going a long way towards getting rid of this curse, whatever it is, under which you operate.

I mean, the public has to express its needs through some kind of authority and if that authority is producing the situation that you describe, it is not doing its job properly by the public; and it is time it was thrown out.

VOICE: Or further to that point, the public has to express its needs through its own constituency, not through elected officials. I think one of the supports for this argument is that architects and people involved in building start thinking of themselves more as political animals, thinking in terms of what the user needs, seeing the examples of people solving their own housing problems especially in low-income economies anywhere in the world, South America, Africa; the squatter settlements outside of Halifax, Nova Scotia in Canada. These people have minimal resources and have taken the onus upon themselves to go out and get what they need.

We are coming here and saying we are going to act as mediators to the housing process and we are going to give them what we think they need, imposing our own value system. These guys are doing it for themselves, very much what Mr. Mitchell's system was indicating yesterday-- to develop some kind of neutral framework that could be transported all over the world without imposing a cultural bias, in which people could operate and effectively manage their own resources. I think we have to come to the realization that we have a lot of gall to come and say, "Okay, we are going to design for you a beautiful environment." Nobody has proven what a beautiful environment is, or if a healthy life is contingent upon a beautiful environment.

MR. WRIGHT: Well, it seems to me you are taking a lot on yourselves as architects, because I find myself in rather a lot of difficulty here, when I hear a situation described that is really quite foreign to me.

A building is a very complex product and it consists of structure, fabric, and mechanism; and it is quite impossible for one professional person to become a good designer in all those respects. In the UK there is a growing tendency for every building to be designed by multi-professional teams. In fact, the firm I represent is multi-professional; every building we design is designed by a multi-professional team. And a member of the team is a quantity surveyor, who can keep the team informed at all times on what the cost of the design system is. So the question about how do you value flexibility in terms of how the building is flexible doesn't arise.

We can tell you what the cost is at any time in development; and if we need to have the producer in the team. We try to get him in the team. It seems to me that unless you operate in this very realistic way, you are in cloud coo-coo land; you are imagining yourself to be something that you are not, and so you can't be effective, which is one of the points that I think you were making, isn't it?

VOICE: There are two things I want to say in relation to your question. We are trying to establish a direct policy to build housing for low-income people. But the last thing we are looking for is low-cost housing. In fact, the very basis of the policy that we are establishing is to get the best quality housing that we can regardless of price. Of course, the realistic viewpoint of this whole thing is that it isn't what you build, but how you finance it which influences your price more than anything else.

One of the figures that was quoted, I am sorry to say I have to disagree with; if you increase your financing 1/2%, you increase your final rent between 15 and 20%; and this is a matter of difference for anybody who is a low-income tenant.

One of the other things I think we ought to consider certainly is that without syndication there wouldn't be any middle- or low-income housing built in the country. In fact, syndication is a gimmick you can write off if you are in a high-income bracket by buying into our housing scheme. It is a most attractive investment and without this gimmick on the financing end, I venture to say there wouldn't be any housing built today in this country for middle- and low-income people at all. I don't know where systems building fits in or how long this gimmick will go on. I don't know, because at the moment it is the great thing as far as investments are concerned; and like all great things, they tend to be taken in such a way that sooner or later somebody gets hold of it and this gets stricken from the tax record.

What will happen then, what other gimmick will appear in its place? I don't know, but these are the realities of the situation. I have not heard anyone address himself to this. I think this is the real environment you are concerned with, building middle- and low-income housing, operating under those constraints and never mind architects or anything. You have to have an architect in your package to work up a nice housing package. The architect has to be good enough, so he can guarantee you that the building will stand up for the life of the mortgage.

But anything after that is of no concern to anyone; and this is how the real thing operates in the housing industry. Ask any house builder who knows the financial situation-- it is the banks who dictate and no one else.

Can I have an answer from anyone on that?

CHAIRMAN deMONCHAUX: Neal promises an answer for some time.

MR. MITCHELL: I was asked the question, so I will answer it. I hope you don't get upset at the answer, but I should begin with a short story.

It is the story of the chicken and the pig. They were riding down the highway early one morning, hungry, and pulled into a little roadside restaurant. They got out and the pig stopped the chicken and said, "You are not going to eat there." The chicken said, "Why not?" "Haven't you read the sign on the door?" The chicken answered, "Yes. 'Ham and eggs are our specialty.'"

The pig said, "With you it is a donation; with me it is a commitment."

[Laughter].

Now I would like to submit that most of us are making a donation, right? And I think it is time to make a commitment; and if the professionals are honestly involved in the problems of housing, then places like this Center-- we always used to look to the universities to do it, but the universities are in some other world at the moment-- it is places like this Center that ought to take on the role of taking over a project and actually building it and publicizing the results for the profession and doing it, as my friend pointed out, in the context of a full systems project; bringing in the right number of people, publicizing the research.

How much real, hard, tangible research have we heard about at this conference? We haven't taken one project and looked at it; and certainly, by God, I am not going to let anybody talk to the people living in my houses...

It would be kind of interesting for us to get involved in the total process.

EDUCATION PANEL

MR. EBERHARD: Good afternoon, I am John Eberhard. My role is to be the Moderator this afternoon. And the program is referred to as the Education Panel.

We can take that several ways. The obvious intention is that we talk about the number of those presentations that have already been made in the last two days on systems that were developed in response to educational needs. We might also look at it as a panel which is involved in our education. And we want very much to have this be a process of interaction between all of you and the panel members.

I won't make any attempts to introduce all of the panel members. Those of you who have been here through the sessions will recognize a number of them.

There are two groups. The group from the United Kingdom, who have been involved in the CLASP system that we talked about this morning. This includes Professor Joe Black, Peter de Brant, Stanley Meyrick and Hugh Morris. Carlo Testa from Italy who is sitting here, talked yesterday.

And then the team that talked about the Surge Building at Stony Brook campus this morning. Mr. Meathe is no longer with us, but Frank Matzke and Bob Ruckterstuhl are here. We also have three people who have not had a chance to present themselves. They agreed to tax themselves in the sense that they will speak for only about three or four minutes-- maybe ten minutes at the outset, and that's not supposed to be stretched to twenty-- in order that you have some idea of the kind of work that they been involved in with respect to education and building systems.

The theme that grew out of our conversation at lunch-- and I think the one that we might best try to use this afternoon-- is to stress three aspects that this conference in its original design and intention has. One is that we are dealing with international subjects. What is happening internationally. So that we want to avoid-- at least the panel does-- the notion of talking parochially of what is happening in the United States or in the United Kingdom, but try, to the extent that we came to talk about interaction between countries, to see in what ways things are happening which are similar, which ways are different, and how we might learn something from them.

The second aspect will place much more emphasis on process than on product. Obviously, one doesn't separate those neatly and cleanly. We have the feeling that there are a lot of process issues which we have not adequately dealt with in either the presentations or the discussions. We had quite a few lively discussions at noontime about process issues. We are probably going to have a hard time reproducing that first act here.

The third,and I think,crucial issue in many senses Professor Black introduced actually in his talk this morning, which is that if we talk about systems,and we are regionally rigorous about talking about systems, one of the characteristics of a systematic approach is that it has built-in feedback. And that the building industry has not characteristically been very well developed with respect to feedback as part of our system of building. So after our first few introductory remarks by the three panel members who have not had a chance to talk to you, I think our intention will be to pick up on that theme of feedback as a part of the institutional mechanism and to deal with those international questions that have relationship to building systems.

I would suggest that perhaps the first man who might introduce himself to you is Dick Jacques.

(Applause).

RICHARD JACQUES: Thanks, John. I guess the introductions are even shorter than the comments. Very quickly, I am an architect and practicing in Albany. I am one of six partners of Rod Robbie, whom I think you heard a few words from yesterday. I guess I came out with the philosophy and I might talk a bit about the problems we have had apart from that philosophy. (Laughter).

I have a speech in my briefcase. I didn't read it because I thought it would be similar to some other ones, but apparently he [Robbie] came on and talked about things that might have been of a political nature. Anyhow, I represent one of four affiliated U.S.-Canadian firms. I am a principal of the firm under my name and President of the Environmental Systems International.

I would like to make some comments about the international implications of the work we are currently involved with. I think I can speak from some hard experience that we have had over the past two years dealing with both the international implications of practice in architecture between the United States and Canada as well as the implications of transferring various systems building technology between the two countries.

Specifically, we have been involved in a number of major efforts to transfer the experiences of the SEF schools systems program into a number of states and localities in the United States. Without getting into any of the specifics, I would like to mention several major international problems that have created a great deal of concern and problems for ourselves.

One is the generally confused nature of the international, provincial and state architecture registration requirements related to the formation of international organizations for the practice of architecture and building systems development. If you think we are confused amongst the several states in the United States, the relationships between Great Britain, the United States and Canada are even more confused and prohibit such things as joint practice of architecture under one firm.

As far as attempting to make direct use of some of the Canadian building systems technology in the United States, we have been faced with a number of fairly large-scale problems; the first being the difference in building standards and testing evaluation between the countries. A good deal of corporate work has to be done here.

Another serious problem that we have encountered and been able to overcome is the difference in the price structures between the two countries. We found it almost totally impossible to transfer one specific aspect of a systems building program to another country or even between states or provinces without encountering serious local problems. The point was raised this morning that one could not transfer a program such as CLASP into other foreign markets without having some modifications.

We have encountered a particular problem in the recent months since President Nixon dropped his bomb in the whole fiscal area. In many cases, technology that would have been both meeting our standards of performance requirements for school systems application and meeting economic criteria were found to be totally unfeasible after the adoption of the Nixon monetary policies. It is a very serious one and something that might be discussed, but I am not sure what we can do to resolve that kind of problem.

I think I will leave my comments this brief. I am sure some of you have questions that are on your minds, but that is all I have to say right now.

MR. EBERHARD: Todd Lee from Colorado will speak now.

TODD LEE: I am an architect in Caudill Rowlett Scott's New York office. Just a few things I want to say: First of all, I think we should be very clear, since most of us are architects of the architect's bias, which is a good viewpoint in which everyone says, "Yeah, I really believe in industrial artist job technology and good systems for building and I am going to start designing right now."

I also think we have probably seen a great deal of process already and I want to show perhaps as an anecdote to Rod Robbie's global view a rather narrow definition of systems through a couple of buildings CRS has built recently. They are not done in ordinary-Venturi; they are probably more self-conscious than that. They are not high powered. They aren't the results of a high building program. They are one client, one job, using existing stuff.

[A series of slides].

Everybody has his own idea of how you build. Let's talk about buildings because I think we get caught up with process too much. I could have brought you all of CRS's fancy graphs showing how you get lots of feedback and higher cost predictability and fantastic schedules and how we do this, but that has been done rather well this morning.

One of the things that is clear is that we know what is happening in education. It does appear that a lot is happening. The schools are becoming something entirely different.

The schools I want to talk about are two vocational colleges rebuilt for Bell & Howell. Small projects. Forty thousand to sixty thousand square feet. They were built in about nine months.

One is a systems building, using conventional hardware that doesn't look like a systems building. It is in Phoenix. It is good space. It is around a court and it has good space and good materials. And the kids seem to be happy; the kids aren't cold and there is good color.

When we were talking about all of this during lunch, when we went up to talk about what we were going to talk about here, and John said, "What are you going to do?" And I said, "I thought I would show slides of buildings as an anecdote." And he said, "Who wants to see your slides?"

We get involved in the processes. We get very involved with what we do and we don't recognize our roles are changing; we need to become political activists and labor negotiators or what you will. And the most important point is not the process nor the product, but it is ultimately the things we are involved in building which reflect the aspirations of our society. I get worried when I come to a conference like this.

There is a dangerous tendency, whether they are management systems or hardware systems, of becoming the "ins" in themselves. We lose sight of the people and the context which has to remain for the best interests of mankind.

MR. EBERHARD: The next man, unlike most of us, is a customer rather than an architect or a professional looking for a customer. Mr. Kantz represents the University of California, and would like to say a few words just to indicate the kinds of things you used to do before Governor Reagan got elected. [Laughter].

R. CLAYTON KANTZ: How little does he know that's right. [Laughter].

Well, if I may boast a little bit, I do represent the University of California and the office of the president. And the University, for many, many years has seen fit to retain presumably experienced architects and engineers to be the go-between between the faculty and the students and the staff in their relations relative to the capital outlay program, and in their dealings with architects in private practice.

Everything at the University of California, from roughly a thousand dollars up, is designed by design professionals in private practice. There is a slew of guys like myself that at one time or another in the past were active in the design professions, either as architects or engineers or planners or something else. In very recent times we have come upon something. The University, over the period from 1950 to the current time, has increased one and a half times, a fair-sized operation, a little over 105,000 students on nine campuses, and 53 field stations at Los Alamos and other radiation labs.

During the last decade, the capital outlay program was in the order of $180 million a year. The last two years, it has been zero except for the levy of a substantially increased tuition. The Regents have allocated that tuition money to capital outlay. So last year, we had about $12,000,000. This fall, we have about $18 million, but no state funds whatsoever the last two years.

Although we had an allocation the year before that, it was withheld.

So times have changed at the University of California. About six years ago in 1965, California was the pioneer in attempting a building systems effort. We started with a project for student housing. Many of you know it by the name URBS-- University Residential Building System. We deliberately selected student housing. No tax money was involved, and if this hair-brained idea didn't work after six months or a year, well, the dust would settle and people would forget it.

Well, fortunately or unfortunately, whichever way you want to look at it, it seemed to work; and now in the process of six years, everything that could possibly happen to a building systems development project has happened.

We are finally to the point where the initial project, eight buildings, $204,000,000 project has been completed in San Diego, and occupied a couple of months ago for the fall term.

Everything considered, URBS succeeded, but it was a hell of a battle.

About four years ago, Vice President Morgan, in the process of doing a little boasting on his part around the country, engendered interest on the part of Indiana University, and that led to the commencement of the ABS, or Academic Building System project. It is quite unfortunate that we let ABS have included within its title the name "building systems" because, whereas URBS does represent what we choose to call the first generation building system mode, most certainly ABS is of the second generation because it is the conceptualization of the total building process from programming through designing through construction and including the inevitable later alterations.

We defined ABS as a coordinated system of procedures, planning concepts, and it so happens some building sub-systems. In the process, we have learned a lot of things. I think the most important is that there is a situation arising-- and I am not sure I want to say this in this audience-- but I think it is time for some questions and answers. By and large, society is quite dissatisfied with both the institution and with the profession of architecture. The institution-- and I am speaking now not as an architect, but representing an institution-- by and large there is an increasing dissatisfaction on the part of institutions of higher education with architectural services, and if things don't change pretty rapidly, you gentlemen are going to be out of a job.

By the same token, the users of the institution are equally dissatisfied with the institution, itself. So that in this process, we talk about systems, building systems and systems building, industrialization, whatever the title, and I think it's terribly important that we recognize that there are two different types of users.

One I choose to call the direct or primary user, and the other group the indirect or secondary user. The primary user is the faculty, the students and the staff; and the indirect users are everybody else that has unfortunately considerably more control over what happens to a building than do the direct users.

And the indirect users then would be the campus architects, the architect, the planners, the programmers, the custodians, the buildings and grounds people, physical plant staff, everybody else that puts a finger in the pie, and unfortunately hasn't a great degree of control over how that building is designed or constructed.

MR. EBERHARD: What I would like to do is start the discussion by getting a couple of panel members to re-discuss in front of you a subject we had discussed at lunch, and as they begin that discussion, I suggest you chime in with questions, answers, and arguments so that we will see whether we can't make this a general discussion amongst all of us.

VOICE: I was very struck by what Mr. Kantz just said, and it is something dear to my own heart. I would like to suggest that we might explore that particular possibility that systems building actually is a mechanism whereby we can concern ourselves with the people's requirements rather than the structure of the building itself. To me, this is a most important aspect, and I certainly agreed with everything he said.

I would like very much at some point during the discussion to see if we couldn't dwell on that subject.

MR. EBERHARD: That is exactly the subject I intended to start with, and which I am going to ask Frank Matzke and Mr. Meyrick to start between themselves. Is there some evidence or some way that we might say that the systematic approach to building or building systems has in fact met the educational needs of what Mr. Kantz has called the primary users?

MR. MEYRICK: I think what we have done is opened up the process in a way that it recognizes that the thing we are trying to house-- the educational process-- is one that is changing. And in the past we sort of focused on defining programs in a way that is relevant to user requirements in a very detailed way.

We asked him to state his needs and be very specific. They caused him to close the door to all other possibilities. He wanted to be so specific that we designed it in such a way that we custom tailored it to that particular program.

I think the process of constructing and planning society spans a time anywhere from three to four or a dozen years. As such, that process was being designed to house something that was changing much faster than could be designed. I think we have come to the realization now that we only have to identify the common denominators of the structure in order to get the structure built. We can leave a lot of flexibility to the user in terms of how the first tenant uses the space.

The buildings we designed had a high degree of flexibility and adaptability. We are thinking about the second guy who comes along and wants to change the building. We went through the process of designing a highly flexible building, and if a guy came back from a campus and was enthused, he wanted to make a change and the architect says, "I am sorry because we have started the working drawings," because the process we were using did not provide that kind of flexibility that the facility itself was intended to provide.

We are not sort of changing our viewpoint in a way-- let's look at the common denominators. What are the common things in the building that allow us to get some of the basic structure going and sit down with the first group of users and tailor something that will give them, at the time they occupy the building, something that is much closer to requirements rather than something that was their requirements three or four years ago.

As we have gotten into systems approach, I think the approach itself gives us this kind of flexibility. I think the process we used in the past wasn't that flexible, so we could not really provide a facility that was up to date as far as the user was concerned.

MR. KANTZ: I would like to substantiate that and I would like to point out that it is the institution's fault more than it is the architectural profession's fault for the way things are today. We have been so busy over the last two decades building buildings just as rapidly as we could that in that process, many institutions have developed rather sophisticated organizations for developing and preparing fantastically detailed programs.

In the case of my university, up until fairly recently, we presented the architect with a whole bible. Every single room was laid out, what was to go in it, even down to spacing and location and heights of outlets, electrical outlets, for an instance.

This, I think, is wrong, because the architects have responded magnificently. In our research efforts on the ABS project, we found somewhat to our consternation that buildings not only within Indiana University and University of California, but also in the sampling that we took across the country from 50-odd other buildings, that architects almost without exception have done a very magnificent job of providing a building that is highly responsive to the initial users.

Unfortunately, the architects have done a lousy job in providing a building that is responsive to the users thereafter. These buildings that are so highly sophisticated for the initial user are difficult and very expensive to alter, and the pace of change that is now taking place within higher education is so swift that we simply have to abandon this on the part of the institution.

The submission of a detailed program-- and this is again a reason why I am so much in favor of phase tracking or phase designing construction wherein there is no opportunity on the part of the institution at least to program in great detail. The architects would be doing a service to themselves as well as to the clients in higher education to push this idea.

What we know as a matter of accounting records is that the cost of change over a period of forty years in higher education amounts to at least twice the original cost of construction. Taxpayers and representatives of institutions get hung up on trying to save a few bucks here or there on material or cutting down some space or squeezing the architect's fee. That's the least end of the duck.

MR. MORRIS: Just an anecdote, a warning. We were handed a bible in 1962, a magnificent compendium. It seemed to us that there were things missing from it because it didn't say things about the nature or purpose of the university or its organization. We looked at some of these things. The first thing we proved after three weeks was that the site was too small, and there was a delay.

There are some huge obstacles that can come up.

MR. MEYRICK: I think there is a slight danger that we look for a scapegoat everywhere. You say the architect is to blame or the institution is to blame or somebody else. I think this may be, if I may say so, a little facile. It is a very complex situation and not the least of the difficulties really is the fact that whatever is going to be done has got to be funded in a way that will satisfy the people that are providing the money.

So you have to have some kind of organized way of arriving at what you can afford. In the past, it seemed natural to link that to what does the guy want. He wants so much space. He wants this kind of equipment. And he wants to move from here to there. And he has got so many lecture hours and so many lab hours and so on. So he cooks all these up in certain terms. He makes a schedule of it and the boys get together and price it, and that becomes a fixing that the architect has to slot himself into. I don't think you can really escape from the necessity to set some kind of financial framework to any project. It just isn't practical politics.

But how to do it in such a way that you don't get the building buttoned up before the architect has had a chance to get at it. And I think this is a very important element in the process.

What is going to be built really ought to arise not from simply asking, "What do you want?" But from a dialogue, perhaps quite a long one, a discussion, and I am hoping that Hugh is going to take this up because his firm, which handled not only the University of Bath, but earlier than that the University of York, arrived at a concept of what the University of York should be by quite a long and detailed dialogue between--and I think I am right in saying-- initially, two people. Two minds, you see, knocking sparks off each other, and they came up not with schedules of accomodation or anything like that, but with a broad conception of what a modern university should try to do, and then they started thinking of a framework in which they could do it.

I represent, and Professor Black represents the financing side of this. We are prepared to accept that, once you arrive at the concept like this. We could say that in the context of a whole expenditure on the university sector of higher education in Britain, we could afford X-million pounds for the University of York, and leave it as broad as that.

So that within that financial envelope, the University of York, with its architects, was able, by means of this kind of dialogue, to arrive at a set of building propositions which could then be dealt with through the procedure, which, if anybody is interested, I can describe, which I hope extends this degree of freedom right down to the point where you let the contract.

MR. EBERHARD: Maybe Hugh could tell us who was representative enough to come up with this.

MR. MEYRICK: I know it is a big subject, but it did seem to me that it is too easy to say it is the architect's fault or the Professor of Engineering's fault. I don't think it is.

VOICE: To put it in another context, there are ten percent of the people tearing the buildings apart, and the other ninety per cent are sitting around yawning.

VOICE: May I comment on that particular item about the architect's providing what the school districts and the educational institutions ask for?

During the last ten or fifteen years, the states have been asking or our state has been asking for educational specifications. But they haven't followed it up, and the educators have not given those specifications to either the state or the architects outlining their philosophy, their needs, as to how they want to carry out their educational program.

MR. EBERHARD: Would you say what state you are from?

VOICE: I am from Pennsylvania.

Now during the last couple of years, this has been made mandatory that the administrators must submit an educational specification to the Department of Education for approval before they can even get approval for an educational project. This is as it should be, I believe, because actually the architect cannot provide an envelope for a school district and an educational institution unless he knows what they want to carry out.

In effect, they have given the architect the groundwork to provide the envelope. But your statement that the architect has not completely carried out his responsibilities in providing that for the districts I don't believe is correct. From 1950 up to about 1965, structures have been designed, and I am part of the guilty persons who have done it, which have not had the flexibility that should have been designed into the building. To make a change in the designs that have been designed for the last 15, 20, 25 years, it is a Caesarean operation. It is uneconomical to make a change.

But if, as in the last five years, we can give them the flexibility that they desire, that they don't have to go into a separate bond issue to make any change in a building so they can carry out an educational program, then I think the architects will be meeting their responsibilities if they provide this for the districts.

This is one reason why we are trying to work and incorporate systems building within the program in Pennsylvania now, and this is specifically why we are here to get all the information and guidance that we can.

VOICE: I would like to inject a few thoughts here. I am from Canada. We have been deeply involved in the FBS program. It seems that certainly in Canada-- and I know this is true for many areas in the United States as well-- the prime requisite seems to be in school and construction. But we have so many dollars per square foot to spend and that is the upset ceiling cost formula beyond which you cannot go.

When we start from that premise, we come back to saying we cannot afford to do certain things and you come to flexibility. I think you have to appreciate the fact that flexibility is always going to demand some additional cost. One cannot have ultimate flexibility without incurring some cost.

[Whereupon, at 4:40 P.M., the recorded portion of the panel discussion was concluded.]

HEALTH CARE PANEL

CHAIRMAN BEST: I think it would be helpful if the members of the panel introduce themselves.

Christopher Arnold, USA
Sheila Clibbon, USA
James Falick, USA
Howard Goodman, UK
Ed Hoskins, UK
Percy Ward, UK
Ray Zambrano, USA

MR. FALICK: I listened this morning trying to figure out what were the problems that I was hearing that I couldn't relate to. I realize that listening to people who have the fortunate opportunity to be from government, or government-funded, or working on theory of architecture and planning, or theory of technology at a university was very nice, but it didn't help me as an architect who has the responsibility to produce buildings today within a certain dollar and with real clients who want to be involved inthe planning and don't see how we can get along without them; and with codes and other conditions of building that tell me pretty well what I can or cannot do

The problem for some of you, maybe, as it is with us, is what do you do without this guaranteed market. What do you do without projects that are all 50 or 100 or 150 million dollars? What do you do if you're with the average health client, whose budget will run from just a couple of hundred thousand dollars or several million dollars perhaps for a clinic, up to ten or fifteen million dollars for the average community hospital? Today we listened to proposals for planning and design that perhaps at best would affect 10% of the country's health facilities. The 90% of the facilities that are labeled health may not be at all able to accommodate many of these proposals.

So I'd like to share with you today some of the things we as an architectural firm are concerned with and have learned how to deal with in with to fit ourselves into what we see as a need; and also to see really if we as a firm can survive in the market. Obviously we're missing one part of the consortium as described in the CLASP setup-- which is the client.

Before I start I'd like to say that for me, I don't know if with all of you-- there's a constant breakdown of terminology. I don't understand people using the same word which can mean many things. Systems, it seems to me are both product and process, as well as technology. And for myself I'd like to break it down to three very simple parts.

First, there's what you might call logical and sensible planning, which is a constant criteria, and which determines the competency of any architect.

Second, is the use of prefabricated elements that are made elsewhere. And the third part, is how to deal with time and construction and design so it's speeded up, and not yield to the fasttrack which Frank Matzke dealt with this morning-- which to me is not systems. It is speeding up of construction but has nothing to do with the prefabricated elements or anything else.

There are three pieces that we're all concerned with-- there's cost, and time and quality. And if we can assume that we're all concerned with the same kind of quality for the moment, then we'll leave that alone and just deal with cost and time. We arrive at various problems. In explaining why a firm should be interested in systems construction, it's easy to see that if you take all the real costs over the past ten years and construction costs at a dollar to dollar basis, that which is built in the factory has stayed pretty stable, that which isn't has gone up.

In addition to workmen's pay, you get the problem of dealing with the weather-- and buildings that are built of prefabricated, factory-made parts have weather problems too, but at least they don't have them in the factory. Also there's just plain bad workmanship that has to be torn down and thrown away.

We looked at what we had been doing in areas other than health on systems building, using standard systems that are available from manufacturers. We found that we were bidding on an average building, about 70% in standard parts; and on some products up to 78% of the building is now pre-bid. If we looked at the construction costs, for pre-bid, fast track buildings that use systems construction or prefabricated elements, we were buying our buildings at mid-69 prices, mid-68 prices, which is this year's track record.

There are several aids, too, that we need to use in working with systems buildings-- I'll define systems building in this respect as prefabricated pieces. The first is the use of the computer to establish constant criteria; and this is a matter of developing a finity diagram, essentially a formula that allows you to say that the kitchen wants to relate, let's say, to a scale of 10, and the beds want to be related to the kitchen minus two on the same scale. You all, I'm sure, know about the oscilloscope and how it can be manipulated so that you can correct the misinformation you feed into the computer. Eventually the computer can draw for you. For instance, on a 4-1/2 acre site for a 600 bed hospital, you can get everything on a site in the right location and test it out and simulate operation and know you've done a good job.

A second tool that is necessary in shortening the architectural design process, that we've used, is systems analysis. This started with the systems analysis study for a new public health service hospital. And in systems analysis what you're dealing with is time and motion rather than the criteria that an architect might put into the project. The problem with any of these static computer-based methodologies is exactly that-- they are static. The information put in one, stays there, and stays the same.

And I wish that I had thought of the term Harness; I love it. But essentially I think what we're talking about is what is our circulation system? How do we move people, goods, information, utilities? What are the pieces that plug on to this? And if we've got a good street system in our hospitals, like a city has a good street system and a good highway system and a good alley system, it might work over a long period of time.

The problem is how do you get people to make decisions about design in a community hospital where they'll have to be working with it and dealing with it; how do you get them to make decisions in a way that's fast and relevant? We started by a process of gaming which takes it out of the sophisticated technology, which may be very naive in itself to assume that one can really plan with sophisticated technology and not with people, and put it into the hands of our client-user group. We've got our colored pieces of paper representing kinds of space-- blue might be beds; orange, service spaces such as dietary; red, diagnostic and treatment; gold, offices; and arrows representing kinds of movement. You start arranging them horizontally and then vertically on a three-dimensional space frame. You review it with the large number of people who really are part of the project; and then work it through large groups until it finally is an accepted solution that is the best that can be produced.

And I think that this is the prime factor in saving time and producing quality; saving money while producing quality. Because, unless you can determine your criteria in some way that is based on the fact that you are dealing with an evolutionary system, something that is not static, so that people have the power to put in their information and their needs, you're going to end up with a result that speed kills.

My diagram, then, is just that-- a diagram for a hospital rather than a hospital itself; the architect follows it very easily, that's his job. In a medical school of which this is a model, this kind of planning led to a very straight forward systems building of what we consider a large span which is 50', with very simply placed elements; because we're dealing with a real budget and a real dollar, and not with people who have unlimited funds.

We also have the problem as in most health institutions of having first tenants and not having the second tenant. This goes on the office-space-theory that we will put in a space for the first tenant. When he moves out at the end of five years, we'll remodel the space for the second tenant and so on. And that's really the usefulness of interstitial space.

Frank Matzke's slide this morning indicated that by combining a systems building with fast track construction, you can save 45% on the time. We translated that in some projects to about 20% of the construction dollar, or more.

In San Antonio, Texas, there is a 500-room Hilton Hotel built with a precast concrete box

system. The rooms were built and furnished off-site and delivered and lifted in place by a helicopter-like crane. We're doing a 250-bed community hospital which uses the boxes, which are not flexible but stack up in the structure: on one side is attached a loft building containing parking; and on the other side is attached ancillary services, diagnostic and treatment services. The reason for going to this kind of system is that construction costs including fixed equipment would be $32.85 a square foot. We're finding that if we go to other kinds of systems construction, the straight forward lightweight, steel system which can be ordered from any place in the country and shipped any place, we're taking our conventional health projects which would take, from the time we're hired to the time they move in, say two to four years' time, and shortening that down to between nine and eighteen months. We are now delivering small community hospitals of between 200-300 beds in eighteen months' contracted delivery time at an average cost of between $25 and $37 a square foot, including equipment. I think this is where the importance comes for at least this country and for architects and planners. No matter what is done to control inflation, construction costs are still running twice the general economy. Unless we can get some of that money saved, we won't have the money or the time to buy better buildings.

So, my reaction is simply that it's a question of what can you do today, dealing with the problems that we have today to get better buildings? And what does that mean to the average client that you have to deal with? That's my position.

MR. ZAMBRANO: I would preface my remarks by saying there is a very definite tread of parallel tracks in terms of our thought and design to the work than Mr. Arnold showed earlier and which Jim was just now talking about. I think we're in to fast track, we're into interstitial design of one kind or another. Our philosophy, where I think we are going and what we foresee as the next steps in the process is that in designing the systems, or the basic components of your structure, you start considering how you can set up a primary distribution and structural system that has some definite life; and identify a secondary component of building that has a verying lifetime, for instance, the mechanical and electrical systems, which might last 20, 25 years; and the functional obsolescence of the actual use-spaces, which might change in five to seven years.

Our goal is a properly designed building, such than the basis structure, the basic organizational system can survive and should survive several lifetimes of use. It is truly a tragedy to do what we often do, to tear down perfectly sound buildings in say 30-35 years simply because they can't adapt. So, I think that, and the economic factors which we have to deal with, will get us to the point in the future where we'll just continue to build. There's a medical center in Rotterdam that's already doing this. It's kind of a megastructure, eighteen stories high. It has a medical school and hospital. On the first six floors the building is in operation with classes going on. On the second six stories they are finishing off the space with interior partitions and secondary distribution systems. On the upper six stories they are just completing the structure-- it's just open space, with elevators -- and finishing the exterior. That's one building that has six floors in operation, six in a kind of secondary stage of construction, and the top in a current state of construction. I think it's a very fascinating idea.

We designed a systems floor with interstitial space for the Boston City Hospital. One area will feed up and down, the other will feed just down-- although I think maximum economies call for interstitial space feeding both up and down. The basic, primary system is designed to have capacity to accommodate any use conceivable in a hospital, except surgery rooms where you introduce a secondary system.

CHAIRMAN BEST: Right now I would like to suggest that Sheila Clibbon get the discussion started by stating what she thinks she's thrown at us.

MISS CLIBBON: I don't think it is a good enough solution to provide a universal space wherever possible for putting anything in. It involves too much compromise. I believe it's best to get the same kinds of spaces, containing the same techniques, together regardless of what departments they're in. Most departments get split up in a very short time all over the hospital. In a multi-story hospital it's got to happen if they expand at all; they've got to go to a floor above or below or some other part of the building-- and then you reconcile yourself to the situation.

I just don't accept that you can accommodate many techniques properly, I mean as well, in a universal space building as you could in one where the constraints which conflict have been recognized spatially.

VOICE: Could I ask at this point-- are any of the hospitals in England using interstitial space?

MISS CLIBBON: Greenwich Hospital is the only one.

VOICE: I was wondering because there are none in this country enjoying it.

VOICE: There are some in New York.

MISS CLIBBON: There they have it for some floors and not for others, so it complicates the solution.

MR. FALICK: But your proposal is the same thing. You use the same terminology and you draw a very decorative diagram, but what you have is a floor, which is a diagnostic and treatment floor, and it's no different from anybody else's diagnostic and treatment floor except that its interspace happens to be above rather than below and above. Then you have a patient floor. And if you look at any hospital, at any architectural design today without worrying if you call it interstitial spaces, but just say enough space to work in, you've got really two or three kinds of space pretty much in the same way, but better able to meet today's needs. You have really loft space, that's the basic form of space for air conditioning that you're allowed to have. You have glass space because of the fact that a patient's room has to have a window; and you end up with some sort of form-- unless you can put all of your beds on one floor, a la Corbu, with skylights. Well, if you then assume you might or might not be allowed to do it by present codes, which is another matter, you then have some sort of form for that space which is dependent upon a window; and would we have the servicing space for it? And that's exactly what we're doing today. You can make interstitial space for two story stories or twelve stories-- it wouldn't make much of a difference.

MISS CLIBBON: No, that's not the point.

MR. FALICK: Really, why would you penetrate a floor so frequently for a man to get into it for service?

VOICE: But you can deliver food or any supplies or goods or information through interstitial space and drop it down or push it up.

VOICE: We have on one hand everyone agreeing that there's a need for more flexibility in facilities than we have at present. We have a group who are in favor of interstitial space, who find it attractive and more flexible than traditional ways. And then we have Sheila saying, "Ah, yes, but there are drawbacks in this which relate to the nature of the way in which a hospital has to be organized." But then there's a third group that I've heard argue in the past, and I was wondering if there are any people representing that group here, who argue against interstitial space for an entirely different reason; they say it gives too much flexibility, it's a waste of money, you don't need it, you can get all the flexibility you need with other methods. And I'm wondering if any here adhere to that group?

VOICE: I think the point you're getting at is that we're talking in some cases a number of academic solutions, when the process should be based upon solving the client's problem. His problem is based on certain objectives he has and the way that he operates within a budget. And it boils down that whatever techniques you're using-- the computer of whatever-- are value judgments based on the program. How do you say interstitial space is better than regular conventional building type? How do you establish a service mechanism in your service contract? Isn't it based on the requirements and the process you have to go through? How do you make value judgments to decide which is better?

MR. ZAMBRANO: It seems what you're permitted, with interstitial space, or zoning of a primary distribution system, is to make basic assumptions about use, and you're free from waiting for that decision to be made, and you're allowed to proceed with primary construction before the final design decisions are made.

VOICE: I want to backtrack a bit. I'm impressed with the fact that automobile construction is constant but building cost is going up; and this may be a partial answer to what we're talking about. It's very deceptive and not factual in the sense that I think we're looking at the problems. The cost of the automobile may be going up very slowly, but the cost of maintenance and the cost of gasoline, cost of pollution is going up much faster. And we're trying, I think, to look at hospitals as whole problems. Hopefully we won't be deceived by little points on a graph that indicate at a given point in time how you look at a macrocosm of the problem. In a general sense, what we've got here is an x-ray of the current, most advanced technology in hospital architecture which we could put together in a room. It's very ranging, it goes all the way from a concept where all the bedrooms must be roof-lit as the true way of life. At the other end, there's the technology of clinging together the industrial capacity of a nation on a computerized basis, applied to certain kinds of standardization, which when applied to redundant requirements, give certain redundant capabilities. And somewhere we're all playing in this game between these two extremes. And, as I see it, at the moment interstitial space is probably a significant tool to deal with most of the problems that we have in terms of organizing design, construction, operation and maintenance into some conceivably wholistic package which we can look at, dissect, put back together again some way so that you can get the pipes in there and get the pipes out; services in, the services out. You can change the function, you can play a more elaborate, more comprehensive game than previously. We can argue about what the content of that should be, we can argue perhaps about how long something has to function. But in general, I think, if you take a look at the broad picture, the wholistic view is the one we're really trying to get a handle on.

In a certain sense, the British are ahead of us by having advanced an invasion into the field of construction beyond what we do. And we're taking another cut at it based on American applicability, American competence, American trade union practices, which are quite different. And, Sheila is looking at something that isn't really that much different except that her bedrooms are all in a row. I don't see it as fundamentally different.

VOICE: It seems to me that interstitial space is not an absolute. I would say by definition of interstitial space as opposed to simply a hung ceiling with utilities above it, is that it can be defined as space in which you can stand up.

VOICE: I agree with that. Concerning the reference to the the car, I don't know what the point was, because I question that if we make the car costs higher, would we have less polution? The reference was made to show that that which was made in the factories cost less than that which is made on the site. However, when working with a community hospital, and we're supposed to come up with whether or not we'll be able to afford interstitial space, we must figure out whether we can develop some cost benefit analysis that is legitimate and acceptable to the client, acceptable to the community agencies and the regional authorities as to why that building may cost more in the beginning and pay off a lot later on.

VOICE: Architects are accountable for costs.

MR. FALICK: Everybody is. But when you go in with the idea that using interstitial space is a better way to plan, you find it's the criteria of the cost accounting that often eludes you. Many hospitals that we've gone to are a box construction because there was no way of building them cheaper. The SCSD used steel construction because there was no way of building cheaper.

VOICE: I think what you're saying is there's a cost for flexibility. And this is where-- I've had no experience in hospitals-- but in school projects I think we've had enough experience to show that whereas we plan flexibility in the schools, the people using the schools never use that flexibility; therefore, we were putting a hell of a lot of money into it without any reasons for it. And I have a feeling this may be the same for this interstitial space.

VOICE: Is there anyone here who thinks the flexibility fashion needs a strong man?

VOICE: To some extent.

VOICE: I think the point has been missed, that we tend to see flexibility as a capital cost. I don't know how cost limit techniques apply, but within our national health service, we have a very rigid system of cost limits in which every function in the hospital has a fixed cost. That is, so much per meal, so much per x-ray examination, so much per bed space, and so on. But these are cyclical running costs. One has to hit both the capital costs and the revenue consequences.

When we consider running costs over the life of the building, say 50-60 years, it includes the question of replacement of services. Our services have a life of between 15 and 20 years so we are replacing our services two or three times in the structural life of the building. So when one sees one of these interstitial spaces, one does consider precisely how are we going to replace the ducts and pipes and everything else that goes in there when the time. And this is a chargeable cost.

VOICE: Our national cost for any hospital in Britain, whether regional or a local variation, is the same in Liverpool as it is in London. We could just not cope with a system with a high level of cost variation in a country as small as ours.

We're looking at the total package cost. We adhere to set figures; and if any scheme produced has any interstitial space, the building must have a fairly high structural cost, then savings must be made in other areas.

MISS CLIBBON: What most people do in order to cut down on running costs is in terms of personnel, so we're not getting at the same thing. The objectives of my work are to prove that over a period of x years the savings in running costs of personnel-- nurses and physicians and so forth-- could offset the extra capital cost. You're saying that you can't do anything about it, that you're stuck with the capital cost.

VOICE: We do have a process called cost-in-use which attempts to relate capital consequences. It is possible in fact to use your capital and still have savings, but it's a difficult process because most of the things are intangibles. It is very difficult to get the situation where you can guarantee showing savings with increased capital cost.

MISS CLIBBON: Yes, well as I said it's easier to compare one department with another existing department when they're part of the same organizational structure. But if they're not, then you have to examine the whole system which is a far more difficult job.

VOICE: One of the points of this morning's discussion we didn't make, is the use of computer techniques as resource allocation tools. That is, as one manipulates spaces, one is manipulating not only physical space but the consequences of this in terms of staffing, in terms of source demand on our energy and of food and supplies and a hundred more things. And as they move, they have difficult precipitants in terms of the cost of this. Now, one of the stages in these computer exercises is to produce this resource allocation; that is, not only do we produce the sort of figures that the data has been explaining in terms of numbers of beams, columns and slabs, partitions, doors and all that; but also numbers of staff at all times, and the consumption of energy and supplies.

MISS CLIBBON: Yes, but the computer cannot do that amount of work without using a normal structure-- I mean, what was done at Johns Hopkins was on small parts of the system, like obstetrics, etc. They weren't able to take into account all the factors that they felt were important because they were not able to handle them; and that's an operations research department which is fairly sophisticated. How do you do a whole hospital?

VOICE: Here we are saying that the reason we're going to have the flexible things is because everything is going to change; but if they're going to change, how do we do it?

MR. ZAMBRANO: The objective is to maximize the options for uses. You're less concerned about how the uses change than the basic system that you might provide.

VOICE: You can change the simulation. You see you have a finite population which you can just bend and you try one arrangement, then another and see what it involves in the way of personnel.

MR. ZAMBRANO: But, you accept the premise that you've never going to find the absolute truth, the Holy Grail of medicine; then really you should be designing a system that will take anything that will hapen in medicine.

MISS CLIBBON. No. One can say I've got Hospital A and Hospital B, and I've got a number of patients. I'll give treatment in a certain way

which we can allocate, which is the most efficient vehicle of doing this?

VOICE: That's the fallacy. You do not know what actually will be needed; you make assumptions.

MISS CLIBBON: No, you make the assumptions for the purposes of the simulation, so you can compare two things.

VOICE: If you argue that there's something different about various hospital spaces, then you're going to perpetuate the myth that there is some fixed relationship between the patient and the other spaces. If some new drug techniques are introduced, we might see the elimination of all medical in-patients in five to ten years. It's quite possible to happen and you may well have a 50% rise in out-patient facility requirements.

MISS CLIBBON: It doesn't necessarily mean that the patients are in PSS 24 hours a day or anything. They could be night patients, day patients or any part-time patients; but it's easier to plunk them in one place and take things to them, than it is to take the patients to something else. In other words, it depends upon the complexity of the procedure. If I've got a lot of small things to do to these patients, I'd rather have them all in one place and take things to them, whether they're going to be there for 24 hours a day or what.

MR. ZAMBRANO: An interesting point was raised, one that I'd like to discuss. If you take your statement that the economic life of these buildings is 60 years, yet the life of the secondary uses is about twenty, another approach is to say you give a twenty-year building, and then you just build three of them in sixty years; instead of building one that is going to last sixty years.

JOHN ELLIS: A basic fallacy is the concept of the disposable building in that the disposable building is only fractionally cheaper than the permanent building.

MR. ZAMBRANO: Because of the codes.

MR. ELLIS: But not really unreasonable codes. These are not unreasonable regulations.

VOICE: I think the disposable building makes a lot of sense, except that we don't have the technology to do it right now.

VOICE: The trailer and the tent are enormous improvements over what we've had.

VOICE: I'm thinking of 1000-bed hospital buildings.

VOICE: Could we make 1000 trailer-bedrooms, which would be disposable?

VOICE: Let me go back to 1906 and the earthquake in California which demolished an enormous psychiatric hospital, as a result of which everybody was moved into tents. The result was the immediate improvement in patient behavior and well being. [Laughter]. California in its infinite wisdome decided it couldn't live with such improvement and restored the buildings. [Laughter]. And it's also true that the best medical care that you can probably get in the United States is on the battle field; and this is not something that is translated into our whole culture.

I can't tell you that every surgery performed is necessary; and that's a major determinant of how hospitals and health services are in fact developed and used. What I think we can say is that given that surgery will be performed, we want a decent environment to do it in, and to permit it to change as technology advances. And hopefully somebody will eventually evaluate whether or not that surgery is in fact necessary. And this is the way we have to look at the problem. We can only take little cuts at this system in our own national concept of health services. One of the cuts we can take is to build at least the same quality of buildings cheaper and faster; that's not a bad goal. And what we've been debating is if one way is better than another to achieve that particular thing.

VOICE: We've all said the same thing. Our job is to diagram some pattern for providing health care services. We establish a harness or movement system, or vertical core, or whatever you want to call it-- fixed elements. And the rest of the space ends up being platforms of one kind or another, be they horizontal or vertical, platforms into which you fit these things. And that's the whole major change in health in the past few years-- that's what we've all said in one way or another.

VOICE: Everybody except Sheila is talking about a system to provide space so that every part is capable of having an operating room or an animal room, and so forth.

VOICE: Not necessarily.

VOICE: No.

VOICE: I guess there could be different degrees of flexibility. I suppose in the interstitial space at least there is a mechanical area and a people area; mechanical flexibility and human flexibility operate on different orders. And that there is a permanent part of mechanical systems-- the twenty year part. But I wonder if you can make it totally flexible; if perhaps more emphasis doesn't need to be placed on degrees of flexibility. Maybe patient rooms are less inclined to change, or change in a different rhythm than the rest of the building spaces in a hospital.

VOICE: I wonder if we're hung up on the definition of interstitial space. I know, Mr. Arnold, you have two basic kinds of interstitial space-- the deep system and the narrow system.

MR. ARNOLD: That's another system.

MISS CLIBBON: There's a distinction between interstitial space and bonafide suspended ceiling.

MR. ARNOLD: In a sense, what we're talking about in the VA project is space in which the horizontal services run, and it has sufficient dimensions such that men can work in there; they have access to it horizontally and can work in there whether this is for initial installation or later change. And the basic access to that space is, in our case, through a service bay-- a door that opens into it so that you do not have to penetrate a floor.

In our case we had a complete platform, call it a floor, call it a ceiling, call it what you will, and there's a provision for taking loads of men working there and equipment; and on the underside it has specific performance requirements in terms of acoustics, etc.

Now, true, in almost any conventional building you have a space between the ceiling and the floor above in which you run horizontal services-- whether you call it interstitial space or not. I think that we seem to be talking here about the use of this space as a specific strategy for making later change easier-- remodeling services easier. And it's just specific strategy in response to a problem that I think we'll all run across.

VOICE: Is the reason you put such a space, or floor, so that you don't disturb the people below?

MR. ARNOLD: Partly. It's one of the performance requirements.

MISS CLIBBON: It's access that I've been dealing with; for example, I've got a solid membrane that I can enter wherever I like without having to get at it with a pneumatic drill.

VOICE: Distinction should be made between minor alterations and major alterations. When you have a major adaptation of space, changing its complete use, say, the patients are going to have to be moved out of that space-- whether you have an interstitial space to work in or not. Therefore, you can have the view that we are putting too much into having permanent structural interstitial space.

VOICE: Does the interstitial space and flexibility you're talking about reduce the cost of major change?

MR. ARNOLD: We've done rather careful studies, and in terms of making quite major changes that work out in some detail, we found we got a 40% reduction in cost. Now, this is part of our argument to a client which we won't have to make to justify the extra costs for this kind of construction. Now the extra costs do not appear to be very great, given in terms of our study. However, it's perfectly obvious that if I show you an interstitial space design with a floor to floor height of eighteen feet, you can always reduce the cost, clearly, by knocking six feet off our design.

VOICE: Let me comment on that, Chris. Another aspect of this thing is that we're trying to examine how in fact you put a building together. And these are very complex systems, and we're trying to develop strategies so that a plumber can work like a plumber. And this is very difficult to do. He's got to have a platform to work from. He can either have that platform from the floor below of ladders or scaffolds, or he can walk on a continuous platform to do the work. Part of the cost of the ceiling is the part of the scaffolding, and it

therefore reduces the cost that appears in some other fashion in the building process. What we're trying to do is to look at the problem as wholistically as we can. At this moment in time, that seems to be the approach to take. In ten years if people can get air into smaller spaces and smaller plumbers, we'll change the system. [Laughter].

VOICE: We thought of this, that having a completely self-contained floor on which the installation of the services could take place, this would reduce significantly the cost of installing services; in practice it made virtually no difference at all.

MISS CLIBBON: Yes, but yours is not a proper man-enterable space, because I can only just stand up inside it, and I'm an average female. So most of the men in Greenwich can't stand up.

MR. ZAMBRANO: Basically, you reduce flexibility and adaptability of buildings, if you have cores in the vertical center. Vertically fixed elements are hard to change; and you limit the adaptability. Interstitial really tries to put as much as possible in a horizontal plane. For instance we've done analysis where even in conventional hospitals the sandwich, the structure of mechanical gets to be five and six feet in the service areas and about four feet in patient areas: 2-1/2 feet for structure and a few feet for mechanical equipment. And if you take interstitial and put it together in one, and feed up and down, the total volume will not increase whatsoever.

VOICE: One thing interesting we found toward the beginning of our project was we went around hospitals to find out how maintenance people actually did maintenance work in conventional, non-interstitial space buildings. We found two very interesting things. One is that almost all the maintenance men are ex-navy mechanics used to running around in submarines and that sort of thing. In other words they were treating, in many cases, non-interstitial space as interstitial space. They would go up through an access panel, and they would skip along the traditional wires and runners. They could do it; in other words, they were experts.

The architect goes up and looks at it and can't walk around. But the maintenance man does, and it's a skill. So, we looked at this and then we very carefully started to make decisions as to how high our space should be to enable the people to work satisfactorily. It comes out less than the space you or I need to stand up in.

MR. FALICK: Most of the problem in costs of hospitals today is not finding what the square footage cost is, but establishing some new patterns of staffing that will really save money.

VOICE: I've been to a number of discussions like this in that last few years and they eventually ended up in discussion of interstitial space; and usually with people with a number of vested interests defending it or hacking it. I'd like to suggest three points of view: First, that we are not that sure how things are going to go, and so we want to provide a hell of a lot of flexibility just in case.

Second, we do know that as long as there are patients, for example, it would be easier to bring things to them than to take them to the things; that there will be certain characteristics of organization which will persist. If these are incompatible with a certain technology, we ought to have a hard look at that technology. And this is for reasons of the hospitals' being able to do their job properly and more efficiently.

And the third point of view is that we can know something about the future in terms of general degrees of flexibility that will be required; and when you buy interstitial space we're spending money for flexibility that we're never going to utilize-- more flexibility is unnecessary.

VOICE: I think there is another argument in favor of interstitial space. I can only speak from our own experience as structural engineers on one 1,000,000 square foot hospital for the Health Services Administration of New York City, which is that it allows the whole building process, the actual start of construction to occur much earlier. For this hospital which is really enormous, the foundation construction began when only just the barest outlines of the building were understood by the architects. The structural steel contractor met when the designs for the building itself were very little further advanced. The steel shell is under construction; and still the interiors of the hospital are far from being planned. I don't think we could have gotten that kind of rapid progress unless we had the kind of initial flexibility and also the great long span that the interstitial space concept allows.

It's hideously expensive. But that fact only means that escalation costs would be even more enormous-- so there are advantages to implementing time saving concepts.

I want to comment on the predictability of health care because that's one of the points we're trying to get across. In the first place, the VA study is geared to a particular client who has particular kinds of needs.

Every new VA hospital will be a teaching hospital, and nobody in the Veterans Administration can predict what a dean is going to do. The way this shows up is, for example, in the treatment of gastric ulcer patients. They can be treated in a variety of ways, one of which is to associate a bed, a laboratory, a radiology room, and a resident's quarters in very close proximity. And this takes an enormous amount of very concentrated space in order to deal with that particular category of illness-- and the VA has lots of such patients available.

They may wish to institute a health program for these patients with some configuration of this kind, but they cannot predict at which institution the dean will buy it. So, it's not that they don't know they're going to have a particular patient classification, they just don't know what teaching program is going to be instituted. So, the patients are there, the methods of treatment are known, but the combination is unknown. And this is a response to that particular kind of requirement. It's to be able to meet a range of needs.

At the moment we don't need a surgery in that particular context because I think we can stabilize a patient fast enough to get him down to surgery. If this is wrong, we'll restudy the system. But we try to that kind of need for unpredictable program development more than for change as change itself. If we get that, we can handle the changes.

MR. FALICK: For our part, most of the community hospitals that we've had have not been able to afford the extra dollars to provide interstitial space, say in the nursing areas which is the highest defined cost-patient area. And so, our job has been to figure out how to get flexibility in five or ten nursing systems, and to check team nursing versus non-team nursing, versus everybody's theory; and to produce a design which can provide flexibility. We need a design where you can change lots of parameters without changing the building-- I think that's the challenge.

VOICE: I agree. I think we should be talking about interstitial space as the process rather than the product. We automatically say because we've got to do this hospital in a certain time schedule within a certain budget, we're going to interstitial space. But it can vary depending on your mechanical distribution, etc.

VOICE: One hospital in Greenwich is flexible in structure and everything else, but also in its planning form. We've got two phases now with the third phase under construction. The first phase has been open for 2-1/2 years, We've already had three distinct patterns of nursing management in that building. And this varies between small nursing units of 20 to 40, up to units of 90, and back down to units of 60. And I don't doubt there's as many more nursing management systems for the next several years.

DR. MARVIN SACHS: I represent the user or the client, and look at this from a slightly different point of view. It's perfectly obvious that a total systems approach for the delivery of health care facilities for the whole country would in principle be better than what we have now. But what would it be like in practice?

One of the reasons I think this country is not doing what England did more or less successfully, is because nobody knows how to do it. It isn't possible to transform the system quickly into something that could be made to work. If anyone came up with a way of doing that, I have little doubt that pressures for implementing it would be extremely high. And the pressures would come primarily because it would serve two purposes: 1) it would allow better distribution of health care, and 2) it would be more economical.

So if you're willing to admit that we don't know how to do that now, we have to start with the base of the existing system; and with this in mind I've been really very excited by some of the presentations made today by all of the groups which get at ways of providing facilities for us who have to use them, more effectively, more quickly, with less cost; a variety of attempts to solve the problem which nobody really knows how to solve.

The work that is being done at Department of Health and Social Security, which is quantifying and utilizing sophisticated computer techniques for making predictions that are certainly very interesting. It's quite clear that it couldn't be done in the United States at this time for several reasons, not the least of which is that we haven't got anything like a good data base, and in principle we're not sure that we can have one that would be adequate.

The "Veteran system" is certainly straight forward and simple, rational and will probably provide the Veteran's Administration with a much better group of facilities over time with respect to cost than they now have. But if you look at the effort that has gone into finding out how to organize and design health care facilities in the United States, from the point of view of basic investigation, you still have a large amount of work ahead.

We're dealing with an industry which is now something like 70 or 75 billion dollars a year, which will very rapidly be up to 100 billion dollars a year; but the rate of escalation will be reduced because people will refuse to pay more. And the amount of effort going into research really to get to a primitive, basic comprehensible and powerful understanding of the variables, and how they might interact, is extremely small.

I might point out that medicine was in this position about 75 or 100 years ago in terms of medical science. At that time we hardly knew which way to turn in dealing with any number of very serious illnesses, some of which we still don't know what to do with at all. But there are a whole host of them which subsequently were dealt with effectively, and the amount of effort that went into getting those solutions was huge-- it took not necessarily a year or two or five, but in some cases a generation or two before the understanding and comprehension of basic concepts that led to practical solutions which then seemed simpler, were evolved.

So, I make a strong plea that the architects begin to work out a solution for developing a stronger research tradition and a stronger base for supporting architectural research, not necessarily only in the area of health care. I suspect this would be true for housing as well. I think it's been done much more effectively for schools. For some reason there's been more money available to study schools.

Now, the whole process and role of research is something which is fairly unpredictable. But if one looks at the accomplishments of scientific research, the basic issue has been that real breakthroughs require new concepts; they don't come from modification, refinements or arbitrary decisions to simplify. Real advances come from real concepts and these are concepts that have to be testable and have to be susceptible to being proved wrong if they aren't any good, and modified after they've been shown to be wrong.

In some cases you may actually have to build a whole host of buildings and find out that they don't work before you can realize that the concept is wrong, which is an expensive and unfortunate way. But if some other approach isn't evolved, that's what you're going to have to do, and it may not be possible to say that any one of them will be anything like as good as what we have now. It may not be, but I don't think that pessimistic view is appropriate because the chances are that with a little bit of brain power put into it, ways ought to be found to make some reasonable judgment as to what is at least rational or sensible and what isn't.

The building really does influence the way we work. The hospital building is not a passive partner in the distribution of health care. It molds the ideas of doctors and nurses and patients about what can be done; and it can do this in an extremely strong way.

When I started working in this research effort on hospital buildings with Sheila, I was so naive. Its appalling how little I knew about the way health care really has to be implemented in terms of the building as an important function of this. Any number of decisions that we've made in our institutions, that I can recall in retrospect, were made because the people who were involved didn't realize that it was only the conventional building spatial arrangement that was dictating the choices, and the choices were not necessarily good.

I'm interested in the question of predictability of health care in the future. You brought this up as a major issue. Yet is it really necessary to be so fussy about it? We can all agree that we don't know exactly which diseases would become curable or eliminated or which new ones might come up. We can agree that the advancement of medical science, which has been rather dramatic in the last century, may or may not continue as rapidly. There will be social changes in terms of what will be appropriate to provide for people, that we can guess at. So we have to look not so much at whether there will be changes, though that is certainly important, but at what activities or what functions are unlikely to change very much, and which ones we know might change.

It seems fairly clear that the things that are not going to change are those that people need whether or not they're sick-- place to sleep; food, water; toilet facilities; companionship, privacy; air, light; certain amount of sympathy, attention. That is, things that are relatively primitive or relatively unchanging if you give a certain stability to our civilization, which of course it may or may not have. So, these kinds of relatively simple, primitive needs of people, whether or not they're sick, are relatively stable; and these needs exist in hospitals or other health care facilities just as they do in homes.

The clinical techniques which are usually referred to as diagnostic and therapeutic services have really a certain stability. But there are some details that are crucial to architecture that we cannot predict, such as the equipment that would be required.

That brings us then to the interstitial floor issue because that has a lot to do with the non-human systems. A few years ago people weren't talking very much about interstitial floors, and yet from my point of view the problem wasn't any different from what it is now. It's more a question of general organization and how reorganization can be interfered with or not interfered with by the building.

I don't believe for a minute that you architects are getting anything like a decent set of instructions from the doctors who are your clients. If you depend on us to say what buildings we need, you are all going to be in terrible trouble because we just don't know. And it's highly unlikely that we're going to be able to find out in a reasonable time. We need to be taught by someone whose training it is to find these things out-- architects are trained to find out what people need; doctors are not except in medical context. We don't know how to find out what kind of buildings or spaces we're going to need, but we do know how to find out what patients need in medical contexts. You can't do that.

One of you may come to me with a medical problem and say you're not feeling well. If I say, "Okay, tell me what it is you need and I'll give it to you," I think you would fire me on the spot. But that's often what architects tend to do, come to a hospital and say, "What do you want?" And then you say, after we've told you, "That's ridiculous, we can't possibly give you that because..."

Still there is some basic assumption that what we can tell you is close to being right-- except that we're too naive to realize that it's too expensive. It's not that simple. But we need your help desperately to find out what we need from our buildings. We physicians will help you architects help us, but you'll have to learn how to guide us through the process.

SOLVING THE HOUSING PROBLEMS OF THE POOR IN LIMA

ERNESTO PAREDES
PERU

In reference to "housing" there are several definitions and ways of looking at the concept. It is, therefore, important that I begin with an indication of what is included in this term for me. Housing is a term used in a comprehensive sense to mean habitat, a place where you live, a very important component of the general environment which should be molded by the family, adapted to its needs and used to maximum benefit. The house is a shelter from physical, social and economic evils, i.e. from climate, rain, wind, delinquency and financial insecurity through use as investment and insurance.

Housing is more. It is a social system. As a social system, it has actors, operations and results. The results are not only production of shelters but also the creation of agents of change and resources for development.

Housing as a system can be thought of as several interrelated subsystems. We will talk about two of them today.

Subsystem A. The modern housing industry which takes advantage of all the building industry processes and techniques and deals with problems of inputs and organization of a highly specialized productive process such as in the USA and Europe.

Actors are: builders, contractors, engineers, architects, financiers, consumers

Operations are: hierarchical system with centralized decision-making for construction processes.

Results are: production of housing to be purchased by consumers.

This system is incipient in Peru.

Subsystem B. Housing production by the poor, which is to a large extent independent of some other social subsystems related to housing, such as land markets and those producing services such as credit. This production is dependent on other social subsystems such as those producing consumer goods such as cement, steel and bricks. The poor are trying to solve their own housing problems by constructing their houses utilizing family labor, some contracted services and long-term savings capacity.

This is occurring in most underdeveloped countries where processes of rapid urbanization are producing large urban centers with a high proportion of migrants and high population increase. Problems of unemployment and underemployment and distribution of income are fundamental in these situations as well as their result in deficient housing for the poor.

There is need to identify this subsystem. This means to identify its components, operations, products and internal and external relationships. There is also need to rationalize subsystem B or replace it so that better housing is produced for the poor or by the poor.

The purpose of this talk is to deal with how to improve the results of housing in subsystem B, very often identified with Latin American squatter settlements. We want to improve the system in the three aspects stated before: shelter, social mobilization and resource mobilization. I would like to make a quick reference, however, to the way subsystem A operates in Peru.

Most central agency programs operate through contracting with private contractors as builders or directly building through government offices. International agencies stimulate this type of activity.

The private building industry builds primarily for the middle and upper income groups.

Statistics on Lima indicate:

A. Increasing concentration of population in Lima and other urban centers. In 1940, 10% of the national population was in Lima. In 1970, 22.6% of the national population was resident in Lima.

B. Increase of population in the metropolitan area is occurring at a rapid rate--6.2% yearly; 3.2% through natural increase, 3% through migration. There are approximately 75,000 migrants arriving yearly in Lima according to estimates made by the Plan de Desarrollo Metropolitana.

C. In 1967 20% of the families with highest incomes had more than 60% of the total income in the area. Twenty percent of the families which had lowest income held only 1.3% of the total income.

D. Nearly twenty percent earn less than $23 a month. Approximately 40% earn less than $70 a month. 76.5% earned less than $184 a month.

E. The population resident in "tugurios" or central city slums was estimated by city planning offices to be approximately 18% of the total of nearly three million.

The population living in houses constructed by users through the processes of subsystem B were estimated at 25% of the metropolitan population in 1967. Estimates calculated that the proportion of persons resident in these areas, having risen from 14% in 1959 to 25% in 1967, will rise to approximately 40% in 1980.

Lima is, therefore, obviously a case in which the analysis and improvement of the results of subsystem B are of considerable importance for the development of the urban area.

The experiment of Accion Comunitaria del Peru gives emphasis to the role of the user. We consider this appropriate since so much housing is produced almost entirely through subsystem B in which users play a predominant role. The experimental program of Accion Comunitaria looks at the user as having great capacity to produce and reduce costs while keeping finance flexible and adabtable to variations in family economy.

This is related to the concept of "progressive housing" in which the house is a springboard for family financial growth rather than a static commodity. The house is an insurance against economic instability by capitalization of savings through investment in construction. This is important in an inflationary economy.

It is hard to convince technicians and politicians that an estera shack may be better, i.e. more adapted to a given situation, as a stake or claim on property than all the rhetorical radicalism and elegant designs of the politician and technicians who do not have the solution to the financing involved in the actions required.

What should be done? We concur with John Turner when he discusses housing based on "open services." There is a need to make services available in metropolitan areas in order to make more operational possibilities accessible to individuals interested in building. This is the ideal which does not exist, however. In Lima many services necessary for rationalization of user activities are not present or when available are too expensive.

The major problem, therefore, is how to take into account the capacity of the users including their managerial and organizational ability in an environment with a shortage of economic and technical capacity.

We value the freedom of each individual (actor-user) to decide on the actions he wants to undertake in order to achieve certain results, mostly improvements in the quality of life--in this particular case in housing conditions. We also know that this freedom is limited.

First, by the small number of different alternatives for action open to him. He might get land through invasion or squatting but the land market with legal property title is far out of his financial possibilities. He might save and build a house but he has no credit.

Second, by the abuse of mass media which create desires for products but do not show the means, ways or actions necessary to achieve the desired results.

It is, therefore, necessary to change the systems. It is very important to find methods or models or generalize actions that can enrich the individu-

al's experience through changes in the system and even within the limitations of the present system assuming that changes in one unit set up pressures for change on the part of other units.

ACP aims at the development of models which innovate new methods and coordinate the use of resources in such a way as to maximize benefits. We develop these models through tests in the field which enable people to respond to real stimuli.

These methods are based on various assumptions:

- The development of models through experience is based on the free cooperation of the actors. This demands that the stimuli be clearly seen as roads to a desired high priority achievement or product. "No conscious or complex action is likely to be taken unless those on whose decisions it depends expect the benefits to outweigh the cost of inaction," says John Turner and we agree with him.

- The maximum use of resources is a desired goal. Labor, managerial capacity, savings and external finance should be used to the maximum possible.

- The presence of an agent which serves as a catalyst of local resources is desirable. Organization of the users in the community is a model which has been tested by ACP in its two and a half years of activity. ACP has worked as a promotor in the formation of groups which can act as catalysts through a series of actions and reactions within subsystem B. Most actions tested so far have been based on democratic participation.

  The presence of a catalyst is important in order to marshall resources as well as to create feedback to the actors from the "context" or environment in which operations take place.

- Feedback information is important for the actor-users as well as for other subsystems in order to increase innovation, change and efficiency of the general social system.

In accordance with the previous assumptions ACP plays the role of an agent of change by giving initial stimulus to series of actions, reactions and feedback.

ACP plays this role as a test of the hypothesized necessity of this type of agent in the housing process. Once this necessity is verified through action a model can be established and this role can be placed by 1) other available agencies, 2) new services established by central housing agencies or 3) improving the internal structure of the components in such a way that they perform better. The presence of ACP should not be considered a crutch to the housing efforts of the user but rather as applied research. Applied research presupposes certain knowledge acquired through earlier basic research and in this particular case is oriented to improve performance of the system.

ACP is searching for methods necessary to make better use of existing potential. For this purpose we are carrying out small scale experiments. Some are concerned with social mobilization through organization; some deal with resource mobilization through new financial structures in the communities and the creation of new work opportunities; and other experiments deal with improvement of the technical capacity of the users to produce housing through technical assistance and innovations in design and construction procedures which make use of the concept of progressive construction.

Let's see a series of slides which will give an idea of the context, achievements and failures of the 75,000 people trying to solve their housing problem in Lima in what we have called housing subsystem B. (Slides are not reproduced in this publication; the captions tell the story.)

View of Barriada: Outsiders see these houses as "rings of misery" around metropolitan areas in developing countries. This is a generalization that does not always apply.

We consider this a housing system providing solutions given the context of the country and the general tendency for positive development from straw mats to brick.

View of Callejon; Market in Downtown: The houses are started because of crowded conditions in central city slums, low income and failure of the building industry to provide low cost housing.

Graph Migration: Who are the people? Must understand that the majority of the people are urban. Although 47% come from smaller towns outside of Lima, these are not peasants. Migrants come for several reasons.

Store in Highland: Highways, newspapers, magazines, radio and even television have systematically invaded the isolated world of Peruvian villages.

City at Night: The city with its bright lights and modern buildings promises a future full of hope.

Graph on Production: He hopes to find better wages in factories and as we can see from this chart, production in Lima and adjoining Callao is much higher than in the rest of the country.

Classroom: The migrant also hopes that the city will offer educational opportunities for himself and his children.

Hut Surrounded by Better Buildings: Migrants tend to move into the central city. But the city closes in on them and they will move when they can.

The historical process has been for establishment and residence in the urban area prior to a move to the system B areas, although the tendency for direct migration is increasing.

Factory: People need work before they can afford the costs of investing in their own houses.

Women in Factory: 46% of the population living in subsystem B areas are in the working ages between 15 and 64. 46.5$ of the economically active population is empoloyed as laborers.

Markets: 10/7% are employees of white collar workers, 1.9% in management. 28% are employed as independent workers, frequently in markets or as artesans. 3.8% are domestic workers.

Women in Estera Store: While there is unemployment, the great majority are employed. Underemployment is probably much greater a problem than unemployment.

New Dwelling: How did they establish their houses? The occupation of vacant land, normally State claimed "erriazos" is done quickly overnight to avoid police interference.

Buying Straw Mat: Recent arrivals solve their housing problem buying straw mats at low cost. Even this low cost easily rises beyond a day's wage.

Row of Shacks: The shacks begin taking shape along the principal coastal highways and roads since access to the city for work and transport of water and building materials is fundamental for establishment of houses.

Family: The problems are diminished in severity by the joy of seeing their first home away from the central slums. This dwelling is a victory accomplished through months of sacrifice and most families are proud of their accomplishments.

Streets: The houses are established separate from the others whenever possible in order to form the streets of a new neighborhood.

Carpentershop: Public services become more available... such as a carpenter shop. Small stores for sale of food and other daily necessities spring up all over.

Painted shacks: A few families paint the straw mats in an effort to better their condition and express their desire for progress.

Wood house: Others look for more permanent building material...

Painted bricks: This is not the first time painting has contributed to illusion in architecture.

Man with wheelbarrow: After a wait, the head of the house has enough money to buy the first bags of cement.

Foundation: Foundations are put in around the straw mats and the bricks wait for the work to progress. Many times the construction stays like this for months.

Construction: Until one day the family, with some help from neighbors, relatives or contracted workers, starts to build the walls of the first room.

For lack of technical advice, work must be repeated at times-- doubling the cost. Water is scarce and the tools primitive.

Brick walls around shack: In spite of the difficulties the walls are finished and fence in the aging shack of straw mats.

Roof of straw: The family uses the brickhouse with a straw roof for a long time. A cement roof is one of the most costly steps of the construction. Roofing is one of the areas needing most attention from experiments in materials development.

Street with brick houses: Slowly the neighborhood is transformed into streets of neat painted, brick homes, some with two stories. The houses come through user efforts almost entirely alone. The community services come through efforts carried out in collaboration with other residents and with the government.

Street with bus: This might take ten years or more and improvement will continue provided the services are there. The story of each pueblo is written in the mosaic of its buildings.

Hillside development: They slowly advance towards the final stage of construction or they stop and start decaying like most hillside developments.

Dry street with cans for water: What are the negative factors present which inhibit progressive development? The lack of water is one negative factor present in many of these areas.

Slope site: Many of the hillsides have the advantage of being near central areas but some of them have problems of slope as well as problems of access to markets and sources of supply.

Lack of income is another source of problems for development.

Man sitting on wheelbarrow: Lack of employment or underemployment is a problem.

Garbage: Lack of community organization may be a reason for inability to solve community problems.

Piles of bricks: Nevertheless, in most areas the straw mats, open ditches, piles of bricks and bags of cement talk to us of a town being built.

Two story houses: The straw mats are giving way to bricks and cement in progressive development of housing and services.

Paved street: We assumed that the catalyzer is community organization so we tried different approaches to community organization. We developed a model in 1969 for improvement of the structure of the communities. It provided for regular change in membership of the executive committee and controls through a widespread communication system. Later a similar model was adopted by the government for use throughout the country.

The structure of the organizations is based on block representatives, coordinating committees and an executive committee. Basically it provides local leadership for social mobilization.

Promoter: The community is stimulated to adopt new structure. This is done through discussion sessions in which the idea of the organization structure is presented.

Crowd gathered for elections: In the communities in which Accion experimented the structure was accepted as appropriate. Associations in the past have had little formal control either from outside or from the residents.

Voters: This is changed through the use of the secret ballot in which each individual votes for block representatives.

Pledging: Pledging responsibility is carried out at a ceremony for the formal installation of officers.

Classroom: Further training programs for the leaders are carried out. These are specifically related to the interests of the community and designed to provide the leaders with the skills immediately necessary to begin projects desired by the community.

Committee training: Meetings for planning are held to specify details for projects selected by they community through general meetings are through the block representatives.

General meetings: The leaders discuss the program with other residents of the community.

Assist education: It is necessary to assist the communications development of the organizations through preparation of a variety of programs and materials for educational purposes.

Jornada: The most important at the present time are the "jornadas"-- a kind of intensive round table working session which begins with a general meeting, breaks into small discussion groups and returns to the general meeting for discussion and approval.

Water tank: The slides which follow are a few from a synchronized slide-sound presentation about the development of a water system.

Mother and daughter: In pueblo jovenes the majority suffer a shortage of water. It is stored in barrels after purchase from unsanitary tank trucks.

Water costs more for the residents than for the consumer in the center of Lima who has full service of running water and drainage.

Promoter: The block representative is responsible for visiting all the members of his block securing their cooperation, in some cases through saving in a program which provides interest on funds deposited.

This requires widespread cooperation of the community for success. "The solution is in our hands" is therefore the logical conclusion of this audio-visual service.

TV: People from within the community with special talents and leaders participate on television programs designed to promote participation. Our weekly program includes messages from central agencies. The use of closed circuit television will allow us next year to reduce the cost of educational activities and to assist in creating a dynamic, new system of education.

Learning by doing: Accion also schedules projects which provide opportunities to learn by doing. Here community residents learn organizational skills.

Construction: They learn simple techniques of construction through participation in the development of a community center.

Women's activities: Women are encouraged to participate and learn skills which encourage their personal, social and economic development.

Bank desk: A community saving system has been experimented under the stimulus of Accion. A bank clerk with assistance of local leaders receives the weekly savings. A series of controls and checks against mismanagement have been created to fight against lack of confidence in financial systems for community organization.

Man in door: Some people have to be sought out...

Collector: The elected treasurer of the block has the responsibility for collecting. It is hoped that this system for saving will be effective for a series of community projects. We are at least sure that it is having an effect on the attitudes of bankers who prior to this time had little or no contact with these communities.

Women sewing: The training of women for jobs to improve the family economy by increasing their own production for use or for sale is an important aspect of Accion experiments in women's activities.

Woman and child: Work is being carried out for the development of a system of women's organizations for the operation of daycare centers. These centers enable children to receive adequate care while their mothers go out to work.

Shoemaker; meatshop; carpenter: In the field of economic promotion a limited number of subsidized loans were made available to artesans and small businesses as the initial step to development of a rotating loan system which would operate through private banks without subsidy. The experimental loan fund worked in connection with the establishment of small labor-managed workshops and microindustries. The initial investment is through a loan from sources like our experimental loan fund. This loan is paid in an average of two years at ten percent interest. This repayment is made possible through general income produced.

Leather: The participatory nature of the workshop gives stimulating results. The members shortly after a first training course reach excellent quality standards. It takes longer to establish good marketing and administrative practices.

Weaver: This type of workshop is an association of a cooperative type in which total ownership is held by the workers.

Bloquetera: We are beginning a second type of workshop in which the participation in the management is shared by all members equally. In this cement block factory the leaders are elected by their fellow workers. Ownership of the capital is held by the lending organization and the workers have the property in usufruct with no opportunity to become owners.

The lending agency charges depreciation costs and interest on the capital as rent.

Bordado: We fell that one of the most valuable aspects of the experience with microindustries with which we are involved is that it opens opportunities for innovation, not only within the housing system but in other social systems related to it.

Topographer: The last area of action is technical assistance. To test the capacity of the community to produce and as information of the technical prerequisites for action, technical assistance, like topographers, is provided. There is a high priority for layout as a first step in the process to claim property titles from government agencies.

Enripiado: Assistance is given in the organization of finance and work for improving the roads. Consolidating the roads in sandy locations is of high priority for water distribution is usually done by tank trucks.

The government receives pressure for this kind of infrastructural work. It was demonstrated in this experience that the cost to the neighbor was nearly the same either waiting for the central agency or working directly as managers. In the second case, a builder was contracted on the basis of the savings capacity of the community.

School: As a result of the earthquake suffered by Peru a year ago May [1970], Accion has been active in the transfer of methods used in urban areas to development of rural areas affected by the quake.

Bloquetera: Here engineers are providing technical assistance to community organizations formed to manage the problem or reconstruction on projects such as this school in a small highland village.

Centro comunal: Community centers are buildings of high priority to the residents. In this community center there will be offices for the local association, a daycare center for children of working mothers, a store for the sale of handicrafts made within the community and space for other community activities.

Summing up...

Solving the housing problems of the poor is not a matter of changing labels and calling positive what was before negative. This is the case in the abuse of the term Young Town applied in Lima to all settlements indistinctly of the progress or deterioration taking place within them.

The housing problems of the poor could be summarized in the incapacity of the present housing systems to take into account not only the needs of the poor but their capacity and resources.

It has been stated that subsystem A (the normal legal housing) is not operational for the very poor in Lima. Probably this is true in very many metropolitan areas in the Third World. Unless major technical innovations are made to reduce cost and improve the economies of these countries this will continue to be true. At the moment it is difficult to foresee these changes in the near future, but it is easy to see that the urban population will continue its rapid growth.

Therefore, it is important to rationalize subsystem B processes which provide for widespread individual participation and freedom of decision in the development process.

How to improve the housing results in subsystem B? This can be done through:

1. Changing the general attitudes towards housing as a fixed commodity and evaluating it in relation to the housing process and not in relation to fixed standards. The rules are flexible in subsystem B. Housing legislation, standards and regulations are not normally enforced in the areas settled by the poor. The attempts at improving subsystem B should take into account that if regulations are going to be enforced they have to be realistically within the real capacity of the system to produce.

2. Maximizing the use of resources. This can be achieved through research and innovation in several areas:
   - Materials
   - Finance systems
   - Labor intensive construction systems
   - New systems for ownership
   - New systems for organization of work and distribution of income.

3. Stimulating social mobilization. People have a great asset in their capacity to organize and participate. This should be used to the maximum of its capacity. Its development could be promoted by central housing agencies, redistributing investment priorities from those funds oriented toward public housing.

4. Providing technical assistance. It may be believed by some that the people of the poorer communities need only to be educated in techniques of self assistance in order to achieve marvelous results in the development of their communities. Accion found however that the self-help techniques need a complementary input of engineering, architectural and other professional assistance before many projects can get off the ground. Concretely, in Pamplona although all of the people may save and contribute labor to the development of a water system, they cannot achieve the installation without the building project and approval by the government. Equally, the people wishing to build a community center were unable to commence without plans and professional advice. Clearly, much self-help acitivity is paralyzed for lack of technical assistance.

5. Creating a cycle of dynamic education whereby teaching is not a one way process or limited to the classroom. A widespread system must be created wherein what is taught may be applied, tested and adjusted to the realities of the communities in which the education is to operate.

I know that the issues which have come out during this presentation might not be taken as relevant to the situation in Europe and the United States. But looking at the world in its present state of conflict and crisis one has to stop and think that a definite effort has to be made to make possible the participation of more people in the decision-making processes throughout the world.

I am pleased to have been invited to present information about acitvities in Lima. I hope to have an opportunity to talk personally with those of you with particular interest in these or similar housing processes. Thank you.

PILOT HOUSE: THE OPERATION BREAKTHROUGH OF JAPAN

Y. UTIDA
JAPAN

CHAIRMAN DAVIDSON: I'd like to introduce our second speaker this evening, Professor Yoshoshika Utida, who trained as an architect, teaches as a full professor at the University of Tokyo School of Architecture, and quite apart from having an extensive record of many buildings bearing his name, he is also Chairman of the Selection Committee of something that I think many people here rudely call the Japanese Operation Breakthrough, which would obviously be far more accurate and perhaps less uncomplimentary if described by its proper name, namely, the Pilot House Project. Professor Utida.

PROFESSOR UTIDA: I'd like to thank you for your words of introduction. I also feel very happy to have the opportunity to speak to you this evening, to have received the invitation to come and speak to you about the Pilot House Project.

The Pilot House Project was initiated in Japan in the spring of 1970, and was modeled after your Operation Breakthrough Program in the United States. It was felt that, in view of the high cost of real estate in Japan and the rise of construction costs concomitant with recent increases in wages and standards of living, Japan must find new formulas for massive housing construction. The goals of the Project were to keep cost down to present levels, to improve the quality of housing design, and to stabilize the market.

Approximately 101 entries were submitted to the Pilot House Design Competition, deriving primarily from leading construction corporations. There were some exceptions, such as the rather unique designs submitted by the Mitsui Shipbuilding Corporation and by Kubota Agricultural Equipment, Inc.

From July to December, 1970, these entries were reviewed by a Selection Committee. Proposals were evaluated not only for their design, structural strength, facilities, etc., but also-- with a little less importance-- in terms of their manufacturability. That is, did a company have sufficient plant, sales and transportation capabilities to mass produce its proposed house?

Entries from established building companies were rather straight forward, practical, non-innovative; but buildable. Firms that were not previously in the building industry presented the most imaginative and innovative entries; but with more questionable feasibility of mass-production and erection capabilities.

The number of entries was pared down to seventeen winning entries, submitted by sixteen firms.

The entries can be broken down into six main categories.

A. Concrete type, public housing

Since 1955 the Public Housing Corporation (PHC) has lead the way in Japan in developing and using large panel construction; one might think of this method as the mainstream of most future public housing in this country. By far the largest category, there were a number of compelling entries-- the best being submitted by the Shimizu Construction Corporation. Great interest was paid to achieving more freedom in room layout, systemization of panel production, standardization of panel measurements, the use of self-forming joints and simplification of on-the-spot assemblage; that is, the use of strap and spiral ferroconcrete or post tension construction.

B. Concrete type, town houses

There were very few entries in this category, and they showed little distinction. Most were modifications of proposals for either single or multiple unit dwellings. There is still little demand for this type of housing in Japan.

C. Concrete type, single unit dwellings

Just as the large panel construction of PHC is the backbone of concrete type, public housing, the concrete type, medium panel formula used in national, low-rent housing projects since 1962 is the mainstay of this category. Since the basic design of medium size panels has improved considerably and the panels are readily available from production plants in Tokyo and Osaka, approximately half of the entries in this category involved new ways of using this already existing material. Most devised "wall-bearing" systems or made changes in pillar and roof design, that is, "skeleton skin construction". The latter represents, if anything, a step backward in the development of medium panel housing.

D. Metal type, public housing

In foreign countries, reinforced concrete is used for construction of high rise apartments. Due to the prevalence of earthquakes, Japan is perhaps one of the few nations to use steel frame construction. There were a variety of excellent entries in this category. Some employed large and medium panels in combination with a steel frame encased in concrete; while others used caravan-type housing units set into a "jungle gym" steel frame.

E. Metal type, single dwellings

There was a tendency toward use of larger panels and greater mechanization of on-the-spot assemblage.

F. Conventional type (i.e. wood structures), single dwellings

There is a continuing preference for type of housing among the traditional sectors of Japanese society, and there were a considerable number of entries in this category. Most companies found it difficult to hold costs at or below present levels, however.

At present we are building the sample seventeen winning entries, in order to see if they're actually buildable. The schedule is to have all the work done by March of 1972. [From some of the photographs taken by Professor Albert Dietz in May 1972 at the site, and which appear at the end of this presentation, it is evident that construction was nearing completion].

I imagine that there are differences between the Japan Pilot House Project and your Operation Breakthrough Program.

One problem you encounter in construction is that plumbers and people who install gas lines, etc. are licensed by local authorities, and this creates a tremendous problem in construction work. In other words, if these people don't show up on time, the construction is delayed. So, the idea is to build the system ahead of time at the plant.

My understanding is that one of the reasons for the tremendous popularity of house trailers, the tremendous growth of that industry, is because the construction or building of these things takes place at the factories. It not only saves time and maintenance costs, but it also is a means of circumventing problems which unions create on a construction job. So, in that respect, it helps a tremendouse amount in terms of speeding up the process of construction.

We don't have that problem in Japan because we don't have unions in the construction field on the job.

Still, in terms of saving construction time, we want to prefabricate the houses as much as possible in a plant. One Pilot House winning entry from National Corporation includes a central unit for the bathroom and kitchen. They call it the heart-core of the house.

I should like to go through a series of slides showing the entries of the models that we are presently building.

PILOT HOUSE DESIGN COMPETITION
WINNING ENTRIES

SLIDE NO.	DESCRIPTION
	PUBLIC HOUSING
1	Shimizu Construction; concrete
2	Tokyu Construction; tunnel form
3	Tokyu Construction; concrete
4	Japanese Camus; concrete
5	Tokyu Prefabrication; concrete
6	Tokyu Prefabrication; wet core
7	Taisei Construction; concrete
8	Kajima Construction; concrete
9	Kajima, right, concrete; Takenaka, left, metal
10	Takenaka Komuten; metal (staggered truss or "beehive")
11	Takenaka Komuten; metal
12	Takenaka Komuten, left; Kajima, right
13	Takenaka Komuten; metal
14	Taisei Prefabrication; metal frame, concrete panels
15	Mitsui Ship Builders, right, metal; Shimizu, left
16	Mitsui Ship Builders; metal
	TOWN HOUSES
17	Ohbayashi Construction; concrete
	SINGLE UNIT DWELLINGS
18	Takenaka ICS-PH; concrete
19	" " "
20	Kubota House Company (SPA); metal
21	Daiwa House Industries (Daios); metal
22	National Housing Company; metal
23	" " " "
24	Sekisui House; metal
25	Misawa Home (Core-350); wood
26	Eidai Product Company; wood

Slides 1-6, 12, 13, 17-22, 25 and 26 were supplied by the Takenaka Construction Company.

Slides 7-11, 14-16, 23 and 24 were taken by Professor Albert G.H. Dietz in May, 1972.

The public housing site is at Chiba, a suburb north of Tokyo.

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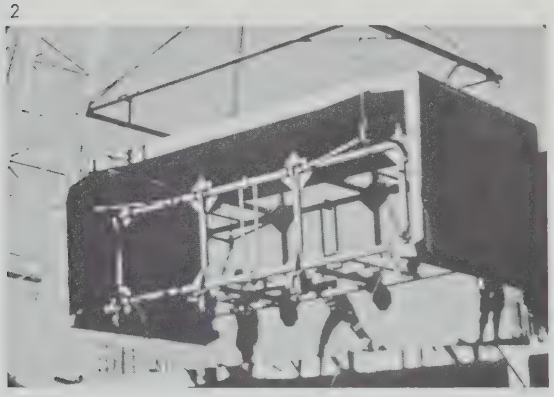

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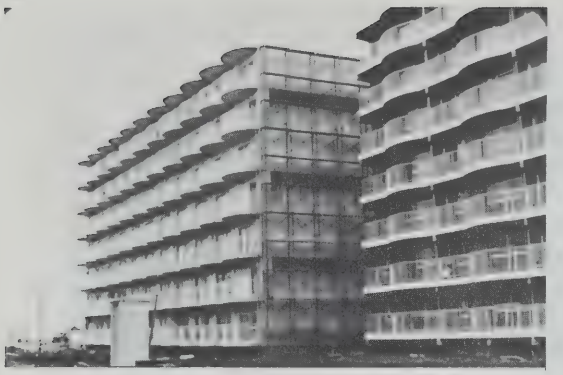

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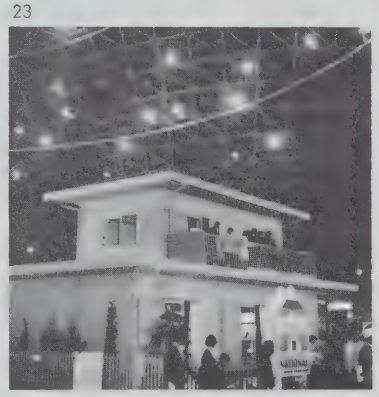

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NEW PROCESSES FOR MAKING US SMARTER ABOUT BUILDING

MICHAEL BRILL
U.S.A.

THE LECTURE I'M NOT GIVING:

There is a kind of "standard" lecture which shows that the real problems are in the process of providing built environment and not in the products of that process; and further, that we should be process-oriented not product-oriented. I'm not going to give that lecture because that's one which is a) available and b) I also consider it might be a waste of time for the following reasons: There are those of you in the room who already agree that the critical issues involve the entire mechanisms of conveyance of built environment to the people who use it at the output end. And there are those of you who say, "that's nonsense. The critical issue is that house, or that piece of hardware or that tower crane." I don't want to waste the time of the people who agree, and I've long since discovered that people who don't agree are not going to change their minds in an hour, expecially on the persuasion of somebody who is long-haired, 5'8", 300 lbs. and peculiar. I don't have a lot going for me as a persuader for this audience. (Laughter.) Another part of the lecture I'm not giving goes like this--if the house costs nothing; if we eliminate the physical artifact called house, there are still lots of people who can't afford housing. It's obviously not just due to the physical thing called "house" that makes costs accrue and, it's not only within the physical thing called "house" that residential services are conveyed. I think you know the crude rule of thumb of cost accruals to the consumer--"the rule of twelfths." The cost to the consumer of this thing called "housing" (notice I'm not saying "houses," but the things that the consumer actually pays for--the house on its lot and the community services, the cost of money, the cost of management, taxes, and a whole range of things which accounts for his monthly bill) breaks down in an interesting way. The physical thing called "the house" accounts for about 4/12. The cost of money, management, and taxes, account for approximately 5/12 while 3/12 is the cost of the land. So 8/12 of the total cost of the consumer really doesn't come from the physical thing called "house" itself.

While it's obvious that many of those costs are linked in some sense to the thing called "house," the critical notion of cost in one which needs a great deal of rethinking. How can we develop conveyance mechanisms for these residential services? Again I want to emphasize that notion rather than "houses."

Let me further illustrate the point I'm not making in this lecture I'm not giving: I want to refer to a study done at the Institute for Defense Analysis, (called IDA) in 1968. It examines the notion that if we actually attempted to meet the housing demands of the nation--that if we actually attempted to meet President Johnson's and President Nixon's desired housing quotas for the next decade of 26 million units with the present process of producing these residential services, it would have the interesting side effect of increasing cost to the consumer by approximately 25%. The report noted that there's a relatively inelastic supply of land; that there appears to be a diminishing amount of labor available, (although labor disputes this) and there is a moderately inelastic amount of materials and machinery to do the job. Given that these supply factors were essentially fixed and that we planned to increase the demand made on them, the outcome is that the cost to the consumer would increase. In other words, the outcome of actually attempting to meet our housing goals would be undesireable, unless we fundamentally altered the very nature of the process. They suggested industrialization as the fundamental altering of the processes of procurement and said that only then would we be able a) to hold costs at present levels--and b) that it would be the only way that we could in fact achieve the quantity goals--that is, with the present industry we simply have no way of meeting the 26 million dwelling units needed.

I want to make an assumption which you may or may not share: that no one here really argues seriously with the notion that the truly critical issues in procuring quality built-environment are really those in the whole process of conveying these to consumers rather than the specific qualities of the products themselves. And further, that the time frame within which these changes are demanded speaks clearly to the notion of revolution and not evolution since we're speaking of almost doubling of housing output.

THE LECTURE I AM GIVING:

I do want to talk about a number of process issues that move us up the next step above normal process issues to those that I think have to be approached and that are not normally discussed. These are processes which I firmly believe have to be implemented along side the fundamental restructuring of the present conveyance/procurement mechanisms. I have a list of five of them and I'm going to try to talk about them sequentially.

1. We need a process of design which is based on the performance of the total system. And by the total system I don't mean the building, the hospital or house, but the system called health care or the system called educational services or the system called delivering residential services.

2. We need of a process of inquiry to make sure we're dealing with the right problem. As an architect, I always had a problem of knowing whether I was actually being asked to deal with the right problem or the wrong problem; and worried that there really was nobody trained to try to figure out that particular problem of "what's the problem?".

3. We ought to be concerned with the process which always questions certain cultural predispositions. It's always very hard to see how our culture affects how we do things. We always look at the "natives," and say "how quaint they are." But we never take a look at ourselves to see how quaint we really are. These notions are important.

4. We need a process for conveying residential services which is both performance-oriented and has a built-in system of accountability.

5. We ought to have a process of feed back. It would be nice to know that we're getting smarter as the years go by in some formal and explicit way.

Let me talk about each of these at some length. All of us consider ourselves as members of the building team. We look at problems from the building end, and interestingly enough we tend to accept an awful lot of our own "conventional wisdon," such as the "reducing-costs-is-always-good-if-we-can-hold-the-quality" concept, and other notions like that. It is quite clear that if we are talking about a health care center that we ought to be concerned with the measures of total performance. How do we know whether a health care system is working or not? Surely we understand that a hospital is but one of many elements within a health-care system, and that the hospital is a subsystem and that its output has to be measured in terms of some larger system's goals. Yet very often we tend to misunderstand that the goals of the health-care system may be different from the goals that we link to the kinds of hospitals that we build.

Let me give you a very clear example of that. When I was first down to work for the Feds with John Eberhard, one of the things that he started was proselytizing other Federal agencies and saying, "Boy, you guys better get on the stick and start procuring on a performance basis. Look what's happened in California, look what's happened in Toronto, look what's happening in Montreal." His general notion was that the Federal government ought to take the lead in such matters. Our particular job at that time was for the Public Buildings Service of the Federal Government to develop a performance specification for Federal Office Buildings. The Feds also had two additional requirements: "It would be nice if it could reduce costs," and "It would be nice if you could increase quality. If we have a choice between the two, we would prefer the former."

We took the job. Being systems oriented, we began to say, "O.K., what are the measures for performance of the total system? What is the total system that we are being asked to explore?" Our analysis was that a Federal Office Building is part of a Federal information processing system which consists of office buildings, men, machinery, energy, sets of

rules, mechanisms for manipulating information and a great number of other things. (And we have office buildings because we happen to be right now culturally predisposed for storing information in office buildings and bringing the people to it as opposed to transmitting information electronically to your bedside where you could do you office work for the day. That's just an aside and not part of the argument).

All we do in office buildings is transact abstractions. We process information. If we take the costs of the total information processing system over 40 years, we get some very interesting numbers: of the total systems cost, the cost of the thing called the building is 2% while 6% is spent heating it, lighting it, sweeping it, keeping it clean--operation and maintenance; and some 92% is spent on people, through salaries that you pay people to process the information. After examining these total costs of the system we asked a question, "Why should we be trying to reduce the costs of what is obviously the least cost sensitive element in this equation. Shouldn't we be talking about some trade-offs and trying to get some leverage out of this? Shouldn't we be trying to manipulate that total system so that we can somehow effect that 92% called people so they could be more productive."

What was interesting was that although many people within the Federal government tought, "that's a terrific analysis and we really agree," no one actually had the mandate to instruct us to say that maybe the building ought to cost more money... to increase the quality by increasing the first cost of the building in order to gain leverage on the 92% called people and thereby optimizing the total system's output cost.

The argument that I'm making is simply that we need a complex process of accounting which takes into consideration the relationship between total systems performance and the performance of the sub-systems that we call buildings. And it's awfully important for us architects and builders to try a little humility (always a good thing) and to have a process which clearly sees building as sub-systems of a much larger system. In this way we might be able to take actions to make the total system perform better, and yes, even at less cost.

A PROCESS OF INQUIRY:

This brings me to the second notion of developing a process of inquiry which makes sure that you're dealing with the right problem. I knew I was in trouble as an architect when people would come to me saying, "I need a hospital" and my response was "you need a hospital? That's absurd; nobody needs a hospital. Maybe you need some mechanism to increase either the quality or the rate of diffusion, or reduce the costs of health-care services. You may have a whole series ob objectives but surely none of those has as the solution the building of a hospital."

Some clients said, "That's interesting, hold off on the hospital for a while." That's not a very rewarding situation if you're going to be a successful architect. Those are not the best questions to ask. You lose jobs. Which is why I stopped being a regular architect.

One of the things that I'm suggesting is that perhaps we need people who are Environmental Diagnosticians, people who may not be architects, but who are fully familiar with what the design professions can do. They need training to ask diagnostic questions like, "What do you mean you need a school? Nonsense. Let's talk about what the problem is." I propose a process of inquiry before one says "you want a hospital, sure! And you've come to the right guy!"

A PROCESS FOR EXAMINIING SOME NECESSARY CULTURAL PREDISPOSITIONS:

I moved three years ago into the very lovely city of Buffalo, New York. I lived all my previous life in Manhattan and I was faced with the incredible experience of having to buy a house. People buy houses in cities other than Manhattan. I was sold a very nice house on a block with a lot of other houses. They tend to look alike except my lawn is a little scragglier than my neighbors' lawns. The houses are all separated by a ten foot alley which I guess is the width of a car with both of its doors open. When I look at it from the end of the block, it looks like a rowhouse, but as I get closer to it, I notice these funny looking alleys. And, of course, those alleys are how we manifest private property and ownership.

I began to wonder if I could have two extra rooms by building across the alley and all kinds of other ideas I've not yet posed to the neighbors because I wouldn't dare! I'm sure their notion of private property and ownership is perhaps more fully developed than a gypsy from Manhattan.

In addition, in the basement of everybody's house on that block is "The Beast"--the thing that sends up heat, sometimes. (In Buffalo that's a critical issue.) Every winter I spend days without heat because it's not working.

When that happens, I give up and call "The Thief." He comes and fixes it and it works again and I give him my money and get heat for a while. I am not alone. Each of my neighbors has the same problem. Yet our separate Beasts (those heating plants) are only ten yards away from each other.

We each have these separate packages called houses, because of the notion of private property and each has problems because of it. And so this cultural notion of private property, real estate and ownership and the little patch of green in the front which identifies me with the American Dream, with our agrarian myth. I would find it humorous except in the winter when I have to deal with The Beast in the basement.

We really have to have a process which can ask fundamental questions about private property, about ownership, about real estate, about the relationship between public and private freedoms. These things really have to be approached because we're not going to be able to solve the problems of housing the number of people and providing the kinds of services that are required unless we can really explore and feel free to explore these kinds of issues.

A PERFORMANCE BASED PROCESS OF CONVEYANCE:

The next process that I'm concerned with is the notion of developing a process of conveying residential services to people which are both performance-oriented and somehow accountable.

We really want the industry (and ourselves) to move from being guys who design, build and sell houses, hospitals or schools, to operators of a process for providing reliable, high performance services to consumer.

When I speak about residential services, I do so for the very important reason that as a user of residential services I should not have to care about The Beast in the basement. What I really care about is that heat is provided to my body when I need it and I can control it. I shouldn't have to care about doors and locks--I care about security. All of the things that I'm concerned with are the outputs of hardware, but not hardware itself. I'm concerned with the services that products provide.

That leads us directly to the performance notion. The only way we're going to move towards the capacity to procure environments on a basis which is related to human beings, the only way that we are going to develop the right kinds of innovation, is to be able to implement the notion of services, performance and output and to try to procure environments on that basis. In order to do this, we must invest in research and development of performance based procurement or we will never have a system of accountability --never have standards of quality shared by provider and consumer alike.

We want to develop as clear a notion of what it is we're selling, as the people who are buying it would like to have of what they're buying.

I gave a talk last week in Philadelphia to a conference on "Evaluation." An old friend of mine, George Borowsky, a planner, drove me over and he said, "Mike, what's the talk going to be like? Should I stay?" I said, "No, you don't want to stay. Mine is one of those talks that starts out by saying that building, America's biggest industry, is run very much like a candy store." He said, "That's not even true. At least if I walk into a candy store and ask for cinnamon gum drops both the candy store owner and I know what we mean." He's right. That level of knowledge does not really exist in the industry that provides health, educational, and residential services. We have not yet developed a language of performance which is clear, which is reliable, and which is shared by both the supply end and the demand end of the business.

A PROCESS OF FEEDBACK:

The last process that I'm really very concerned with is the notion of evaluation and feedback. The building industry has a characteristically flat learning curve. We don't learn so much or so fast for the very simple reason that we are not structured to do so. When I built buildings, a client would come to me who, as often as not, I had never seen before and I would do work for him; and we would send it out to bids to guys, most of whom I didn't know, who asked for sub bids, many of them from guys whom they didn't know, who in turn purchased these materials from suppliers, some of whom they didn't know, from manufacturers who nobody knew. We have a process which is fragmented. Each project is treated as "one-off" where new marriages must be made each time. We really don't have a chance to learn each other's tools, styles, and techniques. The vertically integrated firm and the package builder have great leverage in lese learning areas--they really learn a hell of a lot because they constantly work with the same guys again and again. As an architect, I build buildings, hospitals and theaters, which I never saw in actual operation. I know that many of you who are architects have never gone back to your buildings to see if the design assumptions you made were valid in use. You know the kind of assumptions I mean: "If I shape it this way, people will behave that way." Or, "if I put this space at the hub of circulation, it'll be full of people all day." We don't attempt to validate our assumptions in any formal or explicit way and we don't make formal recordings of assumptions and go back and find out if any of them are true. What's worse, we're so damned arrogant as a group--and I can say this as a member of it--that we reuse these untested hypotheses again and again and again.

SUMMARY:

Let me summarize at this point. I believe our housing (and other built-enfironment) problems are not well understood since the conventional wisdom sees them as having product solutions. I say that it is the processes which are the problem and that many of them ust be fundamentally altered to yield solutions. Many people speak of altering the processes to include industrialization, land banking, new forms of subsidy, aggregating markets, etc. Many of these process proposals are good and I accept them. The processes I'm concerned with here are additional ones which have the capacity to infuse the process with new insights and new knowledge at fundamental levels, so that we professionals can yield the kind of service for which we were trained.

ENCAPSULATIONS OF THE NINE SEMINARS and REACTIONS FROM A EUROPEAN

CHAIRMAN DAVIDSON:

Now we turn to the task of trying to face up to whether we did or did not come up with any truth, however modest, this morning.

The plan is that each reporter will summarize his seminar for as long as he likes up to, but not exceeding, five minutes. (Laughter.)

And at the end he will simply read off this list here the name of the next reporter who will take over without any more formality than that. After we have heard from the ninth reporter some of the Europeans who have been here for the last two or three days will start to tell us not in any way by means of a summary, but an immediate reaction to how they react to what we have all been talking about. Finally, the thankless tast will fall on John Eberhard to try and unravel the mare's nest that we have been creating.

MR. FALICK:

The job of a reporter, I guess, is to pull together what supposedly happened as if something really did happen, as if this were a T-session and tell you what it was.

The topic was "Emergence of New Roles and New Players in Systems Building." We started out by trying to define that there is both a short and long-term look at the new people who are getting into the games; that even without technology new roles are emerging, even without a technological revolution. This is due to a series of pressures on everybody concerned with the building industry.

First of all the architects with a lack of conventional work. Second, the threat of the turnkey or package builders. Third, the pressures from the client who represents not a single-facility client, but the program builders like UDC and the State of New York Construction Fund which have created new roles for the building group especially where the architect now sits on the client's side of the table.

Fourth, the trend towards government control and entry into the building process through FECA, (the Facilities Engineering Construction Agency) and its rules or other new-town concepts and other places where the government will control both the volume and the quality of that volume.

And fifthly, the pressure of defining roles for people when we can't even define the problem to be solved.

We did listen to people's statements and it seemed that the basic problem that our group was faced with answering was one of fear. In the future will the controls for architecture and building be with the private architectural engineering firms or will it be with those aides who are with the government, or will it be some super vertically-integrated company that might be called Ford-Boeing-Austin in the future?

Among the new players we have to recognize the fact that there will be those who were imposed on us, not just those who will be invited to join the game, and that the government right now in legislation is starting to write rules to get people into the building industry who are unemployed in other fields. So we are not just talking about businessmen, labor and financiers, but of scientists and aerospace engineers.

The question came up at the first session as to whether or not the architect really was the man who was best motivated and trained, et cetera, to be in control of the environment or whether he was just looking for a job.

In just giving you a summary of some of the roles that were identified, one is the linkage role, the person who really is the translator, the communicator between the people in traditional parts of the process and the new parts of the process.

The second are those who are coming in in management roles in all areas of the building process. The third is the role of architectural firms; where they in themselves both become the aggregate market and the client.

The fourth is the role of a catalyst; the ability of both the government and the building industry to accept the kind of young Turk who would come in with bright ideas and push them along.

The fifth is the client-user group and right now that was identified as being mainly a response to ghetto problems but that there would be a greater role and a greater way of integrating the client-user into the process.

Sixth, was the series of roles that could not be defined very easily, but represented all the other disciplines and training other than architectural and engineering, not just the social sciences or management or industry, that were obviously going to have to be part of some extended building team to get the job done.

Seventh, was the new strength of the government player and whether we allied with the government player and the legislature all the way through or not.

Eighth, was the fact that even if we can't define some of the roles, there are some people who are now playing one role who are slowly shifting to play another. They are roles that are not in the game now but are becoming imposed on us into the game. Again the example used here was the Federal Government with its decision that facilities should include Fasttrack and systems analysis and cost benefit, et cetera.

In conclusion we tried to establish how a software system might work, and found that we could not agree as to whether a hardware system would work. But it seemed to be that if the owner or the client or the user has a need and he wants a result, then the major role that has to be defined and established is how do you manage not just the solution but the implementation to get from need to product. Perhaps a CPM that tells everybody where and how they fit into the picture and how their information fits into the process makes sense, because systems seem to start with the defining and establishing the process to connect the user with his product.

Unfortunately, it seemed that any number of people from any number of disciplines might fill that managerial role and the architect might not be in it. So the final role that we defined that was needed as the salvation of architecture was somebody who would invent a new role for architects to be part of the process in the future.

MR. RUCKTERSTUHL:

The topic of the second seminar was "Evaluation of Processes and Products in Systems Building." After experiencing the last hour or so of discussion in our seminar, I got the feeling that perhaps Calvin Coolidge would be the best one to be the reporter, because I think about the only conclusion we came for was that we were in favor of evaluation but in terms of any specific things about it, there was absolutely no consensus. We were against any particular ideas about it.

However, we did recognize that evaluation depends upon what you are going to evaluate and how you are going to evaluate it. We talked about these things.

One thing that we found a great deal of disagreement on is who should the evaluator be? This is something I think that is very basic. Perhaps some of you might have had some better answers to it. I think the people who discussed roles might have been able to touch on that.

As far as input into this from the international guests that we had in our seminar, we considered the evaluation process in several different building situations in different countries. We reviewed again the French situation, reviewed an evaluation process in terms of the psychological, physiological, social, and economic factors. After reviewing one typical example, we found out that some factors are reasonably easy to evaluate; at least they are measurable. We can measure the temperature of the environment and the relative humidity

and things like this. But when you reach some of the social problems and some of the psychological proglems they almost defy measurement and, therefore, become extremely difficult to evaluate.

We had input in terms of one of the school building programs in Switzerland and learned about how in light of these difficult fields to evaluate that, the team actually included some sociologists as well as the traditional architects, engineers, and planners.

We heard of the Montreal experience in terms of how the user was involved in trying to identify the requirements which then enabled the evaluation of user requirements translated into performance specifications.

We also discussed some serious problems with which there were disagreements and certainly all different variations of opinion about it within the group.

One point that was made is that it seems in so many systems buildings situations it's the manufacturer who controls the product and what the product is. He evaluates it in terms of economic considerations alone. The question was asked of some of the various systems that were described, in the French system particularly, as to whether there is any way for the architect or for someone who is concerned with human values to get in and make some sort of an input in evaluating the product.

We discussed one of the really basic problems in terms of evaluation. Once you have identified who is going to evaluate and what you are going to evaluate, the question arises about what basic research exists in terms of having the measurements to make the evaluation: And I think as Mr. Brill suggested this morning, the behavioral sciences certainly are very primitive and have a long way to go in terms of providing the kind of information that allows us as architects to measure the important things in terms of the actual performance of the final building.

When we got all through we really questioned whether the architect was capable to take the role of being the evaluator. We heard some descriptions of how the architect now is broadening his education into sociology and behavioral sciences and economics; and whether this was the solution. Does the architect need to have a better educational background to face these problems, or should the architect have some manageable way of drawing upon the skills and experience of people in these fields? We got down to the problem of communication, that in order for evaluation to take place, communication is something that is going to have to be solved among people who don't seem to be communicating too well right now.

Our next panelist, Mr. Russell Brown.

MR. BROWN:

The third seminar was on the topic of "Behavioral Considerations in Systems Building."

We talked about behavioral considerations and we talked about systems building. Occasionally the two came together. I think that in this particular topic we ran into difficulty as far as definition of the points that we were trying to get at, and that again was probably the reason for the separation of the two.

We did come to the conclusion that there were both the open systems that had one impact and the closed systems which had another impact on behavioral considerations.

The measurement of evaluation or of behavioral considerations should be done by people other than architects or designer types. The evaluation of what the impace of a system has on a person's behavior is something that the designer or manufacturer can structure to his own conditioning. It would be worthwhile from now on to think in terms of product and behavioral pattern analysis to being done by non-influenced groups, let's say the educational universities or a third party which can give a reasonable evaluation of what the impact of any one thing is.

A second input based on behavioral considerations concerns the function of a system which takes place within a space which is created by a building system, and the behavioral impact and considerations that were implied by each one of these things.

The one other point that I felt was quite interesting was that for our group we defined an open and a close system; as follows: the first is a sub-component which makes a space and the other is a space which is provided by a building system.

For example, the modular housing industry today is providing spaces to live, relying basically upon the use of closed systems. Dave Crane brought out the question the other day and again in this seminar, of whether the modular systems that were being employed or being used in Jersey City would be successful without the closed system or the individually designed public facilities spaces below?

That is all I have to say and Mr. Matzke?

MR. MATZKE:

The panel I was with dealt with "User Needs Considered in Development of Performance Specifications." We had about 18 or 20 people in the first session and probably about half that number in the second session.

We started out by trying to relate some of the experiences that people on the panel had related to development of performance specifications in consideration of user needs. We called on Clayton Kantz to relate some of the experiences in the University of California, particularly with the development of the performance specifications for the University Residential Buildings System. Mr. Kantz indicated how early in their determinations they decided it was very difficult to define user needs as compared to user wants. They adapted an idea to determine the activities that would take place in the various spaces and by defining these activities let them serve as the basis for the development of performance specifications.

Then Messrs. Black and Meyrick from the United Kingdom outlined the approach that had been taken there in the development of the performance specifications for the CLASP System that we heard explained here earlier in the sessions. They, too, said that they finally related their performance specifications primarily to the activities that would take place in the space.

This led to a number of questions. One as to what we really meant by performance specifications, and two, who are the people we direct the performance specifications to?

I think all of us have had varied experiences in this area. The people who had talked initially were talking about the development of performance specifications which could become a basis for the design and construction of a systems approach to the kind of facilities they needed to house the activities that had been described in developing the performance specifications.

There were others of us who indicated that in some cases performance specifications had been developed in order that a contractor could provide a system or service in the construction of a building.

I think there is a great deal of difference in these two approaches. In our own personal experience we had been involved in developing performance specifications in order that the designer would be able to design a facility which would satisfy these needs. We discouraged the idea of using performance specifications when we worked with contractors, because we felt this only confused the bidding process.

I think the systems approach to building has been the case where they have been able to use performance specifications in indicating to manufacturers what the requirements are in order that they could not only be designed but manufacture large components which would be available to satisfy these particular user needs.

One of the students who was in the session questioned how much student needs or wants were taken into consideration in developing some of these criteria. This evolved into quite a discussion as to whether or not they were being heard, and also a discussion as to whether the people who were responsible for controlling the process or administering the funds had a greater effect on the decision-making than the actual user. This led us into a discussion of flexibility and how to make facilities or spaces changeable or adaptable to the current use needs of the particular user at the time. It was pointed out that we haven't been too accurate

in defining who the user is. In many cases the user might be the student or teacher in a particular classroom. But also in many cases it was an indirect user, the administrator, the dean, the college president who had the influence and defined what should be done and what activities would happen in the various areas.

So this kind of confusion has led to, I think, some confusion as to whether or not the facilities that are being produced are actually satisfying the needs of the user.

We cited some circumstances where the solutions apparently did not satisfy the user requirements at all. This brought out a discussion of high-rise facilities, particularly in dormitory housing and housing of academic activities where it was apparent that the criteria in terms of land use, land values, economic factors, and other things apparently out-weighed user requirements completely, and decisions were made to move in this direction.

Of course, once the people were put into the spaces, they did not like them and protested. Then it was a question that if these criterias had influenced these feelings--say the provision of high-rise spaces were still prevalent--how then could you satisfy the user requirements if you still had to work within these parameters?

There weren't too many answers to that question.

Again we got into the question of flexibility and in terms of, for what user do you provide the facility? Are you talking about the person who is using the space now, and if he wants to change it, how easily can he change the space? I think we agree that somehow we have to find a way of programming facilities or developing performance specifications that vary in scale, not just scale in terms of space but scale in terms of time; so that if we are talking about certain aspects of the facility, let's say the structural system, something like that, it may fit into a different time scale. The need to change may be on a 20-year cycle or not at all. On the other hand, changing the environment within a particular classroom or living space may be something that should be much more fluid or much more flexible.

In developing performance specifications there should be some scale in terms of time so that the designer has some way to evaluate what requirements have to be met. This is the one place where we found that the whole idea of performance specifications had been in the development or statement of user needs and requirements. However, the process does not accomodate a follow-up to see that the specifications were developed. The evaluation of the product is not done to the same skill or degree, as for instance, cataloging performance specification data and putting it into a computer and making it available to them.

In summarizing it seems that we threw a lot of balloons up into the air. I don't know of how many we shot down. I think those that came to learn something about the art of developing performance specifications find that this is not a developed art form as yet, and we have a long way to go. I think all of us realize that probably we have been carrying our responsibilities too far in some directions where we have tried to anticipate needs or at least we think we are accomodating these needs down to the nth degree, specifying the finish on a doorknob and so forth and probably have missed the boat completely in providing what the user really wants.

The next person we have is Mr. Clay Hickerson.

MR. HICKERSON:

I feel that Mr. Matzke left me with a fairly good point to begin with inasmuch as I feel that the other wigth areas of discussion were or are directly affected by this particular area; that is, "Research: Where it is needed? How much of the right kind is being done? Who is doint it?" At least as the questions were proposed over there.

There are three levels at which this group is directly affected by research or the lack thereof--as researchers which some of us are, as professionals or users of what research, and probably most importantly as what I would call lay consumers of housing, health services, or education.

We discussed to a certain extent the problems of initiating and pursuing research within the building industry; such factors as lack of funds, lack of methodologies, which Mr. Matzke was mentioning, lack of dissemination methods, lack of capability on the part of the building industry to make productive use of that information that is now or will become available, and the time lag from the inception of that research effort to the feedback, the time when it is tested or as Colin sometimes refers to, feedforward; that is, the same thing is never going to occur again.

So what kinds of factors can be put into that feedback to make it productive in the future rather than retroactive?

We discussed priorities in the area of research. I think that Mike Brill's reference to the HUD publication dated June 1970, on research funding, what kinds of projects, and so on are going. He pointed out that approximately 80% of the pages described research into materials and specific methods, demonstrating the ease by which we can measure the quantitative aspects of the building industry, and can say extremely little about the qualitative aspects.

Then there ensued a discussion as to the idea of a program of research versus a series of intermittent or disconnected projects, the emphasis being on the difference between the program and the project.

Mr. van Ettinger gave us a kind of research cycle model in which there is a 15- to 20-year period from the time that the project is initiated or the idea to develop or gather a particular piece of information is identified, to the point at which that information is tested and found to be productive.

In that connection it was suggested that the design process or the decision-making process, including in the word design much more than the delineation of form, should become a predictive process rather than a reactive process. That is, look forward to the point at which that information would be productive, taking into account problems in writing the proposal, in getting the funding, in doing the research, in disseminating it into useful form. In that consideration we discussed looking at the long-term constants versus the short-term variables which can be left to intuitive processes of the architect or more appropriately to the intuitive processes of the consumer.

Obviously we can very quickly translate that into some of the considerations that we have heard in some of the presentations of systems in which the in-fill, the furniture arrangements, wall locations and so on may be left to the consumer with or without the assistance of a thing called an architect.

Given this kind of idea of roughly what kind of direction research might take, the question was raised, who is going to do this, the Government, the universities, private industry, or private practice?

And I think we generally concluded that at least at this time none of those groups are likely to have a meaningful effect because of vested interests, funding problems and/or time constraints.

At this point Mr. van Ettinger again described for us the procedure or the process by which the Bouwcentrum does research as a quasi-public corporation on a contractual basis to various groups such as government, user groups or building producers and so on. That information is disseminated through seminars, through publications, or in assistance to direct users such as legislators writing codes.

Unfortunately--I feel unfortunately at any rate--no priorities as such were discussed and no attempt was made to define what is or is not research; so that still I feel we are leaving this discussion with an extremely open idea of what in fact is research? What kinds of lobbying should we do on our part either as consumers, as practitioners, or whatever to ask for this funding to be made available from any number of sources?

I'm afraid, as has always been the case at least with the conferences I have attended dealing with research, there is still a very vague question as to what is and what should be done in the name of research.

The next person is--gee, I can't read who it is, but you know who you are, No. 6. Mitchell, Mr. Mitchell.

MR. MITCHELL:

Our topic was the "Development of Design-Aid Tools for Systems Building."

And we spent some bit of time trying to establish what it was we were talking about and in fact extablish a reasonable vocabulary. I can't help but be reminded of a situation that I was in a little less than a month ago in England when I walked down into the village and there was a fellow building a porch. He had two of the posts up and he was up at the second post. He was standing on a stepladder. He had a tape measure and was trying like mad to get the measurement from the bottom of the post into the ceiling. I looked at him and I said, "Gee, wouldn't it be smart to take the post out and lay it on the ground and measure it?" and he looked at me with complete indignation and he said, "Blimey, Mate, I want to know how tall it is, not how long it is." (Laughter.)

We went through the problem of trying to determine how tall or whether it was how long, and we concluded that there were many, many, many design-aid tools for systems. We could talk about some of them, but we were like the man trying to make love through a pane of glass. We didn't have the computer and we didn't have enough time. We didn't have enough to get into the meat of things and so we got involved in something that I refer to as talkatexture where we talked about the problem. And as we talked, it became terribly obvious to us that in order for us to get anywhere in the future there had to be a common language, there had to be a common resource and there had to be a more effective way of communicating what we were doing one to the other.

So in the true spirit of revolutionaires we came up with a proposal for this audience to say that we did our work. But we also felt that in order to effectively do our work we had to continue and we could find no mechanism to continue. So we proposed one and this is the summation, the entire group wrote this statement and it is as follows.

"In order to meet the overall needs and demands of the country, we will have to improve both the rate at which building is build and the quality with which it is built. This will require an expanded research effort to improve the process and to develop a rational means by which these buildings can be designed, financed, constructed, managed, and operated." And then as a proposal we said, "That in order to effectively deal with this, these national needs and demands, we feel that the Government must structure regional research and dissemination facilities that can gather available information and resources which can be tapped by various building industry interests and which also demands feedback for publications of all results to stimulate additional and continued involvemen."

In other words, we are proposing that HUD, if one looks at our Government for service, function in much the same way as education, welfare, labor, and begin to decentralize the research capabilities, and in fact provide a vehicle by which interested professional can get together, coordinate research, develop research, and communicate with one another. We felt as we looked at the problems of research in the country and as we looked at the problems of our methods, that to pull one thing out as an individual thing and deal with it really defied the whole theme of this conference which was process. In order to effectively control the total process we felt that there had to be a more expanded research base where these tools were developed and disseminated.

So we have wound up with a proposal that the organizers of this conference take the necessary political steps to insure that what has been started be continued, and the dialogue which has begun to be expanded. If it is done on a much broader basis over a longer period of time, hopefully it might be possible at that time for us to come back and say something definitive. But at the end of three days in the traditional T-group ideal of dealing with things we finally got to the issue when it was time to go. We think that the organizers again should structure something so that we can in fact get to the issue and deal with the subject in a more meaningful way at some time in the future. We all concluded that we were not interested to come back again next year to discuss the same things at the same level of involvement.

And so it is our proposal that we do something much more definitive to carry things on in the future. (Applause.)

CHAIRMAN DAVIDSON: You forgot to tell us who Group 7 is?

MR. MITCHELL: Oh, excuse me, Mr. Lawrence.

MR. LAWRENCE:

In Group 7 the topic which we discussed was "How Political and Economic Systems Tend to Favor Different Approaches to Building." I think we also possibly discussed how different political and economic systems tend to favor any approaches to building. (Laughter.)

We started off by asking Leon Charkoudian to talk about the project which was recently launched in Massachusetts in an attempt to perhaps streamline the system of procuring building, and he told us how this got well on the way, how all the technical work and very excellent technical work was done, and how at the last hurdle the project fell flat on its face as there was a lobby representing the vested interests of the unions and of certain people in the building industry who stepped in and demanded that the project be carried through in the traditional manner.

This I think he felt was rather biting the hand that had fed them, but this is part of the democratic process.

Carlo Testa then told us ov a very interesting project which was being launched in the southern European countries. The pattern is to provide small, rather independent settlements, government finance being provided for this. The difference between this and the adding to existing towns or creating new towns was in fact that the people who went into this settlement would have a stake in it; they would be politically independent, they would have their own industries provided and possibly the communications system among these settlements might provide some saving if they had all the modern electronic aids for communicating with each other.

And this we kicked around quite a bit and felt perhaps that these independent people might become a political force who then would demand roads and everything else that everybody else had, so they could run the two cars which they could by then afford. The thine might not quite work out the way it was proposed. But it was thought that if you have got an agricultural community brought into an industrial situation, that this pattern of having not the large ghetto in the large town, but the small settlement might in fact be more acceptable.

We then went on and discussed the pattern of English new towns and what happened there. We asked the question, "What was the minimum acceptable standards for the build environment and what would happen if they weren't provided?" We thought perhaps that the Government should be the people who set these standards.

We then went on and discussed various political systems, whether they be democratic, or communistic, or authoritarian in some other way. We went so far as to discuss the democratic situation and how there is in fact in each country very little difference between the two main parties, and the fact that being democratic the power is held by the voters. But the interesting thing is that each man votes the way he always has done except perhaps for 10 percent of the enfranchised population known as the floating voter who many in fact sway the election one way or the other--not for long-term social considerations, but from the point of view of short-term personal advantage.

We really came to the conclusion--you know the old story of the difference between communism and capitalism, which is that in a capitalist system man is exploited by man and, of course, in the communist situation exactly the reverse occurs. (Laughter.)

We rather felt that perhaps this sort of situation applied with equal force to the built environment, the product of the building industry, and that the general standard of the built environment, whatever the political system, tends on the whole to be rather unsatisfactory.

Inevitably we drifted on to talking about the motor industry, not really from the point of view of the comparisons of how the thing works and how you could put a house on a conveyor belt, but rather the fact that the motor industry forms a very powerful block in any country. We really wondered whether the building industry

and by that we mean the whole industry, not only the builders, but the associated professions, could in fact establish a suitable power base from which they could influence government. We discussed various means of how they could get access to the corridors of power.

Two methods were discussed mainly. First, through politics: that builders, architects, engineers might in fact become politicians so that they could get in on the decision-making process. The other approach is to act as advisers to the Government so that while not in on the actual decision-making, they can in fact provide a constant flow of good advice which would enable wise decisions to be made.

I think that there was quite a difference of opinion within the group about this in that the private members of the profession felt that they were selling their souls if they went in to become servants of the Government and they would be better to preserve their independent position. On the other hand, those who did favor this approach--and I think this perhaps goes more for the European members insofar as they had a consensus of opinion--felt that an outside power group is listened to by the politicians and dismissed while the next chap comes along and makes his particular point; whereas, if you are in as one of the powers behind the throne, then you are really in a stronger position in the end.

As I was given this task of being the reporter at the end of the session, not at the beginning, I apologize for the fact that anything that I may have reported as compared to what was discussed is on the whole accidental. (Laughter.)

Professor Kelly of Group 8.

MR. KELLY:

I also came in the second half of the discussion. When I arrived I think we can say the people discussing the problem of the codes and legislation were happily talking about the New York Urban Development Corporation which on the face of it has the power to skip around them, and the California factory law which in a different way has the hower to skip around them. And we were discussing the possibility that such things might occur all over the place, but recognizing also the possibility thay they didn't really mean very much unless the agencies involved and the people involved had enough public support so that they could in fact be tried out.

As you know the Urban Development Corporation has not in fact overridden any local code as yet. It doesn't feel it is secure enough to do so, although it does have some power simply from the threat that it could.

So we turned rather quickly to the general theory of performance codes. Everyone agrees upon the difficulty of trying to understand exactly how the performance codes would operate; namely, in the form of what kind of review agency does the whole thing operate?

We talked about the difference between having such an agency be private, semi-public, or public and the effect that this might have on its rules being essentially status quo or conservative or perhaps a little bit daring. I must confess that we talked out of both sides of our mouths on both sides of the issue.

We weren't at all sure which kind of an agency was more likely to be conservative or innovative. But I think in the end we tended to feel that since the public is the client in the long run, having most interest in an innovation, the public through governmental agencies was probably the right place to locate a kind of a review agency; although probably having it removed a little bit from direct agency control in the form of a semi-governmental-look-agency would probably be best.

Then several kinds of things came out in legal issues that set us back a little bit. There was some concern about the fact that architects themselves are tending in the last few years to be less and less innovative for a very clear reason; namely, the number of cases that have come out recently holding them responsible for every aspect of a failure of an innovation. We began to ask ourselves whether in looking at the system broadly enough we might not try to look into the question of legal responsibility in the architectural profession. One of our British conferrees pointed out that in the Domino Collapse, although there was a considerable amount of injury done and two deaths, no one had sued the government agencies involved. That would be unthinkable in this country. (Laughter.)

Or we might conceivably find some way by which the profession as a whole or at least as a regional whole would contribute to its insurance policies. With the amount of money that might be available, from reduced rates, they could create for themselves some kind of an information testing and fact-finding bureau which would help them to know when statistically they could dare to take a risk of persuading the client on some innovation.

In short we feel some innovation is required in the system, with the public having guaranteed that it will not be disastrous. If we wish to give architects enough freedom to do some innovation they must not fear malpractice suits.

A similar problem came up when we talked a about my pet subject which is the impace of some of the rapid housing schemes on the form and character of communities.

It was pointed out, I think with considerable justice, that here again we have run into a surprising conseratism on the part of the people who should be most interested; namely the public. The public is at this point clearly reluctant to pay for school bonds and other kinds of bonds for the kinds of facilities that we postulate they very much want.

Obviously this ties in to the form of taxation, to local real estate assessment. We feel fairly strongly that for there to be a recognition by the public of its own interests in its own facilities, there probably has to be a somewhat more rational basis by which the public pays for these facilities, particularly if the public is being asked out of its strength of character to take over problems of people who don't have the usual takpaying ability and do have rather more than the usual tax service requirements.

It was about this point I think that we wound up and if I have omitted anything, it is my fault for having come in late and summarized badly.

CHAIRMAN DAVIDSON:

Well, in Group 9 we worked our way through our subject which was, "Does a Universal, Multi-Purpose Building Building System Make Sense?" I repeated the word "building" deliberately because that is how we tackled the subject.

And we worked through it, I was going to say word by word, but not quite that laboriously. We spoke about "universal" and we decided that we were concerned only in passing with the international implications of "a universal." We spoke briefly about the transfer of software at an international level being a lot easier than the transfer of hardware. The Customs Officer can't stop and pick your brains.

We also for a longer period of time spoke about "universal" in a much more restrictive sense; namely, not so universal as usual. After having done that we then went to discuss multi-purpose building, and we very quickly threw it out as being really a legacy from the past--the appropriateness or rather the inappropriateness of the traditional named building types, housing, schools, et cetera, et cetera, we recognized that if one started to talk in terms of what the buildings allow people to do; in other words, the performance approach to naming buildings, then you can get a lot further away from the present hang-ups and you automatically find yourselves moving to not so un-universal types of buildings.

We noticed from people who have actually done this kind of study, and there were several in our group, that when you start to look at performance types, you find that there are a great number of shared invariants among many of the conventionally thought of different types of buildings. In one or two areas you can in fact identify things that remain to be variants.

The invariants give you in fact the handle to get at eventually producing buildings that will serve a number of the building performance types within which these invariants occur. While taling about invariants we talked about the fit, the closeness of fit or otherwise between the individual users and the so-called invariants of the buildings that were produced for them. We were obliged to recognize adaptability as opposed to flexibility; adaptability being a change by the user and flexibility meaning a change of a building. The very slight misfit that we thought you might sometimes get between

what actually happens and what the so-called invariant part of the building implies, can easily be accommodated by adaptation.

We actually also spoke about multi-purpose as being a specific kind of use. We recognized that people are now putting up multi-purpose buildings on purpose, and we notice that this had one very great advantage in that it got you off the prestigious $30 a square foot physics department kind of approach to life down to something nearer the $18 per square foot approach to buildings that actually perform.

As for building system, we discussed the software aspects of building system very slightly.

We got one definition of building system from our English colleagues which was that every element is fully designed, it being understood before other things happen. Actually we resolutely refused, despite several attempts by the Chairman, to actually discuss the hardware of building system; we resolutely refused to take the industrial engineering approach to life seriously at all.

There was a skeleton in the cupboard, incidentally, and somebody was fool enough to open the door at one minute before one o'clock and we found universal man in this cupboard. (Laughter.)

Now, what happens next? Do we have any reaction from the Europeans or a European? Hugh, is it you?

MR. MORRIS:

No, I can't start as a European at all or even as an Englishman, being half Scot. (Laughter.) And to ask me to speak for Europeans, I suspect, is roughly like asking a Mexican or a militant French Canadian to speak for North America. (Laughter.)

One finds oneself in coming from the United Kingdom in some curious way much more an American in spirit than a European. I don't want to start any kind of political drift and I don't want to follow Rod Robbie in amateur politics, however lively. (Laughter.) That's another conference.

You would be amazed at the curious notions that come from the Old World and my notions of America from I don't know where, Walt Whitman, Jack London, and it is good to see so much wiggling going on beneath the iron heel, if you read that book. (Laughter.)

There is a system which we haven't discussed and I think properly. I have a curious sense of having been brought up with a system approach through giving society names like the Capitalist System which generally speaking, perhaps not in Group 7, we haven't discussed.

I think it is enough if with regard to, as with the State, we adopt Neal Mitchell's phrase and look at Government as a service which is what I think has been a theme of this conference

There's only one accusation as far as the Europeans were concerned ath the beginning of the conference, which I am not sure if we can reject though I think we can--which is the accusation of being hardware oriented. After we had spoken, somebody, I think it was Mr. Ruckterstuhl said, "Why don't you speak with more enthusiasm about what you have done?" And I said, "Because we are visitors and we have a problem; we have done something, we produced some hardware, and we hoped it would be seen as a manifestation of the process that produced it, and taken that way." One can't speak with the sort of enthusiasm that one would speak with at home without the risk of being thought smart which I think we are not.

I don't think that this generalization about being hardware oriented is fully justified, and I throw it back at America with an anecdote from the last week or two. One of my colleagues worked for some time on a project commissioned by the Ministry of Transport in the United Kingdom for a study of urban rapid transit systems and their effects on the enrironment; a rather belated study since three or four years' work had been done with the Royal Aircraft establishment at Farnboro and with industry interested in urban rapid transit systems. One, in particular, called Cabtrack, an automated taxi-train elevated system, we were asked to look at and come up with some conclusions from, I call it a planning point of view to skip the environmental word.

Well, he was invited over here to a conference in Minnesota I think a week or two ago in some terror intrepidation because this is a conference reflecting the fact that "you got to the moon and Vitenam is maybe working itself out." And there were all the engineers and the spacemen and the systems analysts and the traffic experts--and this was a rather shy architect, not even a formally trained planner talking about this thing, feeling he had nothing to contribute.

When he finished, he was completely clobbered, buttonholed, listed to speak all over the place and whipped off to Washington to, I don't know, some Senate Appropriations Committee or something because what he had done was talk about a kind of a software approach to the whole problem to the relationship between where people live and where they are going, to the community structure, the physical structure of towns, of a piece of hardware, and the way in which it had been tested.

The evolution of that kind of hardware in Britain is subject to this kind of testing with a refinement that may not be yet usual here. He got the impression that the States was full of people with pretty highly developed gimmicks ready to market them, using the sort of language that one hears; and somewhere on the check list would be Item 13 of 34, Environment, which meant the commissioning of an artist's perspective. (Laughter.)

This is, you know, not true. I think of the way these building systems have been seen and developed at home.

Our common concern, like yours, is to get the systems approach adopted, to make a more integrated and more coordinated process which starts further back and goes further on and to make that process more democratic--rather not more democratic, just democratic.

And for a moment I dredge up one or two recollections which have been sparked by the conference in the way it carries on, which I will make as brief as possible.

One from an international architectural conference of about 20 years ago which ended with long sessions going right through the night over a lot of black coffee, highly political, chaired by a Czeck whose English was extremely good and who thrashed away compositing completely contradictory proposed resolutions into a common opinion and at the end of the small hours of the morning when we finished, he leaned back and said, "Oh, now we have reached complete unanimosity." (Laughter.) His English was so good that I think he knew what he was saying. (Laughter.) And if there has been less unity and less animosity, I think both, it's been a good thing about the conference.

The second flashback was from a visit of Frank Lloyd Wright to the AA even further ago. I didn't hear his main speech as too many other people were trying to listen, but he went around to studios and muttered, you know, with his stick and white hair and Scotch hat. Two of his mutterings are not recorded actually, and they probably don't appear in any of his biographies, both interesting.

One, after looking at the things on the walls was to look at the students and say--I won't try his accent--"My, my, you boys sure are a lot prettier than your buildings." (Laughter.) And one feels this very mcuh that people are nicer than their artifacts. (Laughter.)

The other was more to the point. After looking at a lot of work he muttered, "Boxes, boxes, prisons for the human spirit." We have seen a lot of boxes and some prisons for the human spirit and I don't say specifically where, but we must watch

And apropos some of the things that have been said concerning the collapsing tower blocks and the boxes for the human spirit--incidentally I think the collapse of that bitter Ronan point early in the morning, killing, which catastrophe was one of the most fortunate things that has happened in the last decade and a real bolt from God if one feels that way. It was a marvellous thing. It put a check on something that should have been checked before. And I'm thinking about that and that sort of ambition of a kind of an industrialized building climbing away. I recollected a poem which I think is Orton's which I would like to leave with you.

"We had ambition by which sin the angel
fell
We climbed and step by step, oh Lord,
ascended into Hell.

Returning now to peace and quiet and made
more wise,
Let our dissent and fall, oh Lord, be into
Paradise."

The relevance you have to sort out for yourself. (Laughter.) If the conference has made us even a little bit more wise in that sort of sense, it's been worth the trip.

And it seems to me that our whole position as architects is being reassessed. One other funny background American picture that I have comes from Ayn Rand's "Fountainhead" novel, very readable, very nasty novel. I looked at the audience in the beginning trying to see which of the two kinds of architects were around--(Laughter)--and this was prompted by seeing that "Grammy's Talking" somewhere in Boston in a week or so. I think the image of the architect as "Fountainhead" as father, going around fathering buildings has taken a damn good knock it it has anything to do with the birth process--and it's a whole delivery process as we have heard; it's a midwife that we may be with a crucial but not a kind of fathering position that we tend to arrogate to ourselves.

Thank you very much for having us, Europeans and other. Apologies if we have talked either too much or too little. (Applause.)

THE SUMMING UP

JOHN P. EBERHARD
U.S.A.

CHAIRMAN DAVIDSON:

Can we ask John Eberhard to read to us the paper that he prepared sometime, somewhere. (Laughter.)

MR. EBERHARD:

Colin persists in his myth that I prepared a paper in advance. That's not true altogether, but it's not false altogether just like many things that have happened here.

I think this session is the sort of a feedback session. There's a process in pedagogical terms that says, tell people what it is you are going to tell them, then tell it to them, and then tell them what it is that you have told them.

The role that I think that Colin would suggest I play is to tell you what you have been told, and to try to say in the process, did we or did we not come up with truths.

I'd argue that coming up with truths has both a product and process notion and that if I were to regurgitate to you in my initimable manner the things that you have heard in the last three days and many of you heard things that I have not heard obviously, even when we were in the same audience-- (Laughter)-- that then would be a product notion. What I would prefer to talk to you about is the process notion.

Ten years ago I was teaching at MIT, not in the School of Architecture, but in the School of Industrial Management, and a young man approached me who wished to be a student in a tutorial class I was offering. He said he had always in his life wanted to be an architect, but that his father worked for a steel company and his father knew how many damned foolish mistakes architects made, so that he didn't want his son to learn to become an architect and that he should get a degree in management.

That young man is Duncan Wilson. He was my student and after he grew up a little bit more, I guess, and married a very beautiful girl from Norway and separated from his father's control, he went back to study architecture.

This conference is in a very large measure-- your response to and should be thankful to-- Duncan Wilson for being the entrepreneur who organized the process which got all of this started and I think Duncan ought to stand up and get a special ovation. (Applause.)

I'm told that, and maybe some of us have heard, that there were a series of round table discussions and will continue to be a series of discussions by a number of young men here in the seminars, young men here in Boston who have been discussing the industrialization of the building process; it was out of that series of seminars that the notion of this conference grew and Duncan in good entrepreneurial style prepared a proposal to the National Science Foundation who in turn provided some funds to at least partially underwrite the cost of this conference.

I see that the process of asking people to attend this conference suggested that it would be a three-day conference which would provide an opportunity for attendees to listen to general experience of international experts in systems building; later in small seminar groups detailed discussions of specific programs would emphasize facility types of housing, education, and health care; and that this conference would give you the first opportunity--I am not so sure about that--to look at the total systems building process of which the hardware building system is only one aspect; to hear of failures--we didn't get too many of those--as well as successes and meet the experts in informal seminars.

"The over 20 years of European experience will be contrasted with newly emerging American theory and experience. No matter what your title, you are involved in education, health care, or housing, and this is the conference which you should plan to attend."

And then there was an application blank to apply to the conference. It was very interesting, the titles that people were given choices of because according to those titles there are not only nine countries more or less represented here depending on how we count Scotland, Hugh-- (laughter)--but there are 84 designers and only six architects.

Now, I assume that since architect was not one of the categories on here that some people just overrode the system, so to speak, and indicated that they were architects, they were not just designers. And that's part of the process.

It's been my observation, since Hugh Morris was observing and looking for people from "Fountainhead" that I think here is a very strong correlation in this meeting as one would expect between the length of the hair and how much of a designer one happens to be. I would bet that the longer the hair is, the more likely somebody is closer to pure design in the architectural sense. You can check that with your neighbor. (Laughter.)

There are 16 government people, eight educators. I know why there are only eight educators; our budget's been frozen for travel and unless we were able to find somebody who was willing to pay our travel or pay it out of our own pocket, which educators historically have not been willing to do, it was not possible for educators to get here.

There were a few researchers, some engineers, a developer, a manufacturer, several clients; but no financiers, at least nobody that owned up that they were, and they are the ones who control the process of building right now. All of us recognize that. All of us in fact have to operate with that reality.

And I would ask ourselves a question about why they are not here. Do you think we don't have anything to say to them, or that they don't have anything to say to us; or maybe if we are not part of the process, we are not part of the solution either.

I think people probably came here in several categories. They came here as unbelievers to some extent; some of them came as skeptics; some people came who were curious; some people came who were fearful; some people came who were hungry; that is, they don't have very much work right now; and some people came as believers in the industrial process. And then a few of us I guess we'd have to classify as high priests although the word used in the program is Expert.

I think everybody heard what they came to hear. If they were unbelievers, I think they will go away unbelievers, because they probably heard everything that they thought they would hear that was negative. If they were skeptical, they'll probably go away still skeptical and they'll be able to say to their friends, I told you so.

If they were curious, they must have learned something. If they were fearful, I would think that much of what they heard would confirm those fears. If they are hungry, I hope they might have found, with the few clients that were here, some possibilities for future work; and if they were believers, halleluja!

Colin Davidson began, as I understand because I was not here, the first day, with a series of definitions for such concepts as the performance concept, industrialization, system, architects, and engineers. I won't repeat those definitions. That's been a characteristic of almost all the sessions that we felt the need to define how we wanted to use the word, because however you use the word has a little different subtlety on how I wanted to use the word. I think that's an indication of the general state in which we are in the building industry right now.

We are in a fluid state. We are in a period of uncertainty and one of rapid change. Whenever that exists in any social group there are anchors that are cast about for. One of the forms of anchors I think that we try right now is definitions.

We say this is what systems mean and then we feel better because almost all of us come from a design background, have much safer anchors if we can feel that the product that comes from whatever process we are discussing is well-designed visually.

We aren't able to measure very effectively yet, I think we would agree, if we are willing to admit it, how well buildings meet other user

requirements and satistactions. Certainly a number of the workshops attested to that.

We do have some notion though of what we'd like to believe good visual design is. We feel reinforced if we can see slides that indicate that somehow or other there are people out there somewhere who are involved in this process who are still producing good architecture.

Then I think the other kind of anchor that we tend to look for and to attach ourselves to is the one that Neal Mitchell coined a word for, at least he used, and I will borrow it, Talkatexture; that is, if we are uncomfortable,we talk louder or higher or more stridently about our point of view and somehow or other we feel better for having gotten it off our chest. That's an important part of the process which I think the designers of this conference recognized.

If only a few of us got up here and talked and everybody else had to listen indefinitely, that's an even more uncomfortable situation. If it's possible for there to be sessions, as there were, for everyone to at least get a chance to talk if he wishes to talk, there's a change to unburden ourselves and to feel that we have made a contribution in the process.

And then, of course, the other anchor which we all have and always have is "my own work"; that is, what I have done whether anbody understands it or appreciates it. Whether it's related well to what other people think the process is or not, my own work is something that I am reasonably satisfied with.

At least I would hope that most of you feel that way because it's a very uncomfortable kind of world to live in if we are not happy with the piece of work that we are doing. But that shouldn't close our minds, should it, to the opportunity of engaging in a process which makes it possible for us to learn.

A conference is a process and a conference of this kind particularly is a process in which we can engage, in which we can use our minds either actively or passively to absorb new information, to test our ideas. The more open we are, the more we are likely to get out of it.

So the product in some very important sense is what happens to us as a result of the process, and not whether or not all of this very elaborate recording mechanism in the final analysis comes up with words that can be written in a report that we can send away for and that Duncan may even be able to make some more money to recoup some of his losses by selling to other people. Those words, interestingly enough, most of us will not reread. We will put them on our shelf or if we are a teacher, we will try to make our students read them. We have sat for three days in sometimes tortuous situations listening to some good speakers and some not so good speakers, when in two or three hours we probably could have read everything. But the process that we were engaged in--of sitting and standing and talking and eating and listening--is something we are more willing to go through by and large, and even to pay good money for, than to sit down and spend three hours reading what would essentially be the same information content.

In the conference itself I think it is not necessary for me to go through in detail the fact that there was a pattern to the process. There was an introductory session and some keynote addresses from Europe and from France; there was a reconsideration of accepted theory; there were case histories of housing education, and health care; and then there were discussion panels in these three areas and then there were special cases that were presented last night, one from Peru and another from Japan; a very strong contrast between countries that are just on the verge of developing an industrial capability and a country which is very highly industrialized.

I was impressed by what appeared to be in the slides at least a certain amount of precision and elegance with respect to how the product was being made by a process in Japan that's probably more industrialized by almost any standard than what we have in the United States. Finally Mike Brill this morning, made in some sense a restatement of the process issues.

One of the reasons I think Mike was so great is obviously because he's my colleague, so I think he would be great any time. A number of people said, why didn't he begin the conference? I think he would not have been as great if he had begun the conference, because we had had our heads processed for two days by whatever thinking we were doing independently and collectively. When Mike came in and presented the set of issues this morning, I think it helped a lot of us put together the thoughts that we had been having about this process, the questions we had, and to provide some structure to it, and in a way which would not have worked, wouldn't have worked as well, I don't think, if that had been the way we had begun the conference.

Then the nine workshops for further discussion were essentially that, weren't they? They were discussion. And we have heard just in the last couple of hours the summaries of those discussions.

Well, there are problems with processes like this. There tends to be at this point in time, because we are in a state of fluidity, an attempt to hedge our bets; that is, rather than having two or three people speak for three days, we got 30 or 40 people on the hope that somehow or other out of those 30 or 40 there will be two or three who really make it all worthwhile for each of us. But since we are not quite sure which three those will be at any one point in time, we got plenty of them, and, of course, the process that results is that we get behind schedules, if we have schedules, and we certainly had in this case. It seems to me that the technology that enters into that has a very devastating role; that is, that slides become the way of presenting for most of us the concepts that we want to get across. If one had 49 slides and the time runs out at the end of the thirtieth slide, except for Mr. Paredes from Peru last night, which I thought was very kind and humble of him--no one suggested that, well, I'll stop, it's the end of my period of time, and there were 19 more slides to be shown and damned if he wasn't going to go through the 19 slides.

So that the ability to adjust what's being said to the time frame is constrained by the technology of the slides.

And then we had, as would happen in any conference, sort of physiological needs that entered into our process of learning. The acoustics were not bad here. At times, though, they required more strain on our ears than at others. The lighting is particularly hard on anybody who is standing here. I suspect that part of my headache may be that I have these lights in my eyes. The food became a physiological reality about 1:30 yesterday afternoon and for me, and it got very hard to just keep on listening when my stomach was gnawing at my insides. (Laughter.)

And then we've had psychological reactions to information overload. That almost always happens in a conference and particularly if it is more than a day long. We've had sociological reactions to peer group identification, and we've decided that that guy and the group that he talks about are the people that I belong to and that's the group that I feel most comfortable with. Or, that guy represents a group of people who want to industrialize the process who don't give a damn about people, and, you know, I really can't see their point of view.

So that when we got to discussions we tend to take, in a good group dynamic sense, positions with respect to the peer group that we would prefer to identify.

Well, that's what we have been involved in to a large extent, it seems to me. The only prepared remarks that I wanted to include here are to talk a little with you, about the notion of an open mind, about what our role will be; that is, collectively in the future, and what it is that this conference might help us do with understanding the nature and the changes with respect to that role.

Three dilemmas face us now which I think in one way or another this set of sessions has helped us to become conscious of, if we were not before, and to help process through our own thinking.

One is that professionals are conventionally seen as those who practice a calling requiring specialized knowledge and often long and intense academic preparation. While this definition is useful in distinguishing groups which are entitled to a certain amount of status in the community, for the purpose of forming professional societies and setting goals of professional practice, it falls short of describing the growing concern with social responsibilities of those who call themselves professionals.

Lord Bowdoin from England, principal of the University of Manchester's College of Science and Technology, maintains that a man cannot call himself a professional until he has found out when he designs something that if the thing falls out of the sky, I'm the boy who's going to carry the can back, until the can is tied to his tail, until he has sweated it out.

Thus I think the medical profession has been subject to socialization in one country after another as the society in which they practice becomes more and more concerned with the access of those who need medical attention to those who practice within the body of knowledge.

Architects are increasingly being subjected to lawsuits which Burnham Kelly mentioned a few moments ago, based on their presumed failure to protect their client from mistakes that their area of expertise is supposed to be able to predict and avoid.

Automotive engineers have had Congress pass a law requiring them to become more conscious of the public safety aspects of the products for which they are responsible.

There is every reason to believe that there will be an increasing pressure in the years ahead to remove from the marketplace the principle of caveat emptor, let the buyer beware, with respect to those products of services that have become too technoligically sophisticated for the layman to evaluate adequately. When we talk about advanced building systems in the hardware sense, I think we are beginning to talk about technologically sophisticated products.

The dilemma here is unacceptability within our society of either alternatives with respect to social responsibility for professionals; that is expecting a professional to develop new voluntary codes of ethics for social responsibility, when he lacks the required tools to assure his clients that he is correct in his advice. Or on the other hand, the imposition by government of mandatory standards which have as their intent removing uncertainty by legislation. Neither of those solutions appear to be feasible or desirable, and hence the first dilemma.

The second dilemma evolves from the expanding concept of individual liberty. Our constitutional form of government, our collective aspirations in society are aimed at the provision of equal opportunity for all. Parallel with this concept of equality has been a constant erosion of authority from above and tradition as a base beneath value judgments.

We are free to pursue each new concept of religious philosophy which presents itself, or reject all of them. Women are perhaps more free to lead independent lives now than at any previous time in history. Each nation is becoming capable of developing its own form of government free from the pressures of colonialism or impositions of authority by force. Our artists, our scientists, and even our engineers are free of traditions which limit their explorations.

The result, however, is that we sometimes appear to be adrift, that we lack the concepts of authority which would guide our efforts. Vannevar Bush pinpointed the dilemma a long time ago when he said, "The search for a fancied and artificial security has often led man into some form of bondage. Men have risen to their greatest stature only when they have had the courage to take responsibilities necessary in order to be free. The attainment of a free society does not mean the end of organizational authority. If it did, no free society could long endure. It does mean a vast change in the way in which authority is established and the means by which control is executed."

Our dilemma is that we lack adequate clear models at the present for how to bring about the establishment of this new form of authority in a way which is commensurate with our professional freedom. I don't think there's an easy answer and, therefore, that's a second dilemma.

We should not assume, on the other hand, as I think has happened often in this conference and happens often in other conferences like this, that if we have identified an area of concern to ourselves that no one is working on it. That's in some sense the worse form of arrogance, because there probably are other people working in an area that is of concern to you. They just don't happen to be people whom you know.

The third dilemma I think grows out of the same condition as the second. We are increasingly unwilling to accept general ideas for guidelines, because they are performance standards; because we are free to examine and to question statements or propositions made by other men; and because there is a natural tendency in an egalitarian society to believe that my ideas are as good as yours. We have a good deal of difficulty in accepting standards.

The standards which were used in common engineering practice have either been accepted because they are of obvious utility, like basic standards for length, mass, and time, or because some sort of law required their use, like building codes. These standards which are incorporated into laws are difficult to accept intellectually both because they are often based on concepts which are too narrowly drawn, such as two by fours, 16 inches on center, or because we have an idea which we consider to be equally good.

It's in this latter case that we have a dilemma and perhaps as Alexis de Toqueville, a Frenchman who visited the United States in 1830, suggested, general ideas are no proof of the strength but rather of the insufficiency of the human intellect, for there are in nature no beings exactly alike, no things precisely identical, no rules indiscriminately alike and alike applicable to several objects at once. The chief merit of general ideas is that they enable the human mind to pass a rapid judgment on a great many objects at once, but on the other hand, the notions they convey are never other than incomplete, and they always cause the mind to lose as much in accuracy as it gains in comprehensiveness.

In the areas of concern of this conference I think we are at a point in the development of our intellectual capital where we recognize the insufficiency of standards based on general ideas. However, we lack most of the knowledge and the associated paradigms needed to make the transition to a new level of understanding.

Therefore, we have, all of us, I think, to continue this process. The proposal which the Neal Mitchell group made is a good one. I think the process did not begin here, though, and the process will not end here.

We have to continue to be engaged in searching, exploring, questioning, and observing, because truth probably in the sense that we could best identify with it is existential; that is, it's always becoming, it's a part of the process in which we are engaged. It's not fixed for all eternity.

And I would like to close not with a poem but with almost poetic words, two paragraphs from Lewis Mumford; the first one particularly applicable to what we have been talking about, when he said, "No matter how completely techniques rely upon objective procedures of the sciences, it does not form an independent system like the Universe. It exists as an element in human culture and it promises well or ill as the social groups that exploit it promise well or ill. The machine itself makes no demands and holds out no promises. It's the human spirit that makes demands and keeps promises. In order to reconquer the machine and subdue it to human purposes, one must first understand it and assimulate it. So far we have embraced the machine without fully understanding it or like the weaker Romantics we have rejected the machine without first seeing how much of it we could intelligently assimilate."

And then he says that, "No society can escape the fact of change or evade the duty of selective accumulation. Unfortunately change and accumulation work in both directions. Energies may be dissipated and institutions may decay. Societies may pile up evils and burdens as well as goods and benefits. To assume that a later point in development necessarily brings a higher kind of society is merely to confuse the neutral quality of complexity or maturity with improvement. To assume that a later point in time necessarily carries a greater accumulation of values is to forget, to forget the recurrent facts of barbarism and degradation." Thank you. (Applause.)

BIOGRAPHIES

CHRISTOPHER ARNOLD, USA

Director, Veterans Administration hospital program, Building Systems Development, Inc. San Francisco, California.

Vice President, BSD. Education: Diploma in politics, philosophy and economics, Cambridge University. B.A. Architecture, London University, M. Arts & Architecture, Stanford University. Associate of the Royal Institute of British Architects. Registered Architect, California. At BSD, primarily concerned with system development for institutional building types. He is presently the firm's principal in charge of the Academic Building System (ABS) study for the University of California and Indiana University. He is also principal representative for the BSD Veterans Administration hospital systems program. He was manager of technical work on the University Residential Building System (URBS) project for the University of California and a member of the original staff of the School Construction Systems Development (SCSD) project-- from which BSD grew-- with responsibility for the systems work on heating, ventilating, cooling. In the office of Reid & Tarics, Architects, before joining BSD, Mr. Arnold was in charge of architectural, structural, mechanical, and electrical coordination for the Health Sciences Instruction and Research building at the San Francisco Medical Center of the University of California. His office experience includes extensive involvement in school, residential and industrial projects.

GERARD BLACHERE, FRANCE

Director, Centre Scientifique et Technique du Batiment, Paris.

Engineer, l'Ecole Polytechnique (promotion 1933). Engineer General of Bridges and Highways. Professor, l'Ecole Nationale des Ponts et Chaussees.

1945-1947: Representative, Ministry of Construction, Germany.

1947-1949: Departmental Delegate, Reconstruction du Haut-Rhin.

1949-1954: Commissioner, Reconstruction et au Logement de Tunisie.

1954-1955: Commissioner, Reconstruction of Orleansville; Head, Service de l'Urbansime des Batiments Civils et de la Construction d'Algerie.

1956: Director of Construction, Ministry of Construction.

Since 1957: Director, Centre Scientifique et Technique du Batiment.

October-June, 1971: President, Conseil International du Batiment pour l'Etude, la Recherche at la Documentation (CIB).

Founder of l'Union Europeene pour l'Agrement technique dans la construction (UEAtc).

JOSEPH BLACK, UK

University Grants Committee (London) board member; Pro-Vice Chancellor and Professor of Engineering, Bath University of Technology.

B.Sc. Mechanical Engineering, University of Belfast. PhD. University of Bristol. Spent periods at the Royal Aircraft Establishment, Farnborough, De Havilland Aircraft Company. Senior Lecturer in Engineering, University of Bristol; Professor and Head of School of Engineering. Also member of National Council for Educational Technology, and has served as Governor of the West of England College of Art and Bristol Polytechnic. Director of South Western Industrial Research Ltd.; Consultant to Parsons Brown-Consulting Engineers, Bristol. Involvement in systems building: As member of the four man planning team for the new University of Bath, selected the Architects and agreed with them to attempt some of the first major buildings in a developed system. In particular as Head of Engineering School planned, acted as client for the new School of Engineering. Organized and supervised the occupation of this building.

MICHAEL BRILL, USA

President, Buffalo Organization for Social and Technological Innovation (BOSTI).

MISS SHEILA CLIBBON, USA

Director, Architectural Research Unit, Department of Community Medicine, University of Pennsylvania, Philadelpia.

M.S.I.A., A.R.I.B.A. Regent Polytechnic School of Architecture. National Diploma in Design. Lecturer and Researcher in hospitals as a building type. Practice: Own part-time interior design practice (1961-1965); Vincent Kling, Architect (Office buildings-- design, interior planning) 1959-1960; Milton Schwartz, Architect (Apartments and houses-- design; redevelopment project competition-- planning) 1959; E. Todd Wheeler & Perkins & Will, Architects (Hospitals-- research, masterplanning, design) 1958-1959.

DAVID A. CRANE, USA

A.I.A., Principal, David A. Crane & Assoc., Philadelphia.

Director of Land Planning and Design, Boston Redevelopment Authority, and later Planning Administrator, BRA (1961-1965). Urban Design Consultant providing services to developers engaged in central city and suburban housing and urban renewal (1959-1961). In addition to office experience in the general area of housing, Mr. Crane has a great deal of experience with the systems aspect of industrially built housing-- in prefabricated housing technology for developing countries with the IBEC Corp., and later, with Carl Koch, in developing the first "Techbuilt" housing prototype. As part of his almost continuous involvement in housing over the past five years, three projects are particularly relevant to a study of Systems Built Housing. These are Fort Lincoln New Technologies Study, the Industrialized Housing System Prospectus for Boise Cascade Corp., and Operation Breakthrough in Jersey City.

COLIN H. DAVIDSON, CANADA

Professor and Researcher, University of Montreal and Washington University, St. Louis.

Trained as an architect in Britain with a Master's degree from M.I.T.. He ran a consulting firm in England until his immigration to Canada in 1968. Editor of Industrialization Forum.

PETER deBRANT, UK

Architect, Robert Matthew, Johnson-Marshall and Partners, London.

Masters Degree in Biology at Cambridge University, England. After a post graduate year at Harvard College, he studied Architecture at the Architectural Association, London. He has been involved in the use of CLASP for schools and universities since the early 1960's and more recently the development and use of CLASP/JDP in universities.

ALBERT G.H. DIETZ, USA

Professor of Building Engineering, Department of Architecture, Massachusetts Institute of Technology. Supervising a six year project, in its fifth year at the time of this conference, "Systems Analysis in Building Design" (supported by the National Science Foundation): Investigation into the possible use of computers in architectural design, especially with respect to space allocation. With Laurence Cutler, conducted summer seminars on industrialized building systems, 1969 - 1972. Professor Dietz has also conducted regular seminars in industrialized building in the Department of Architecture at M.I.T. In 1970 - 1971, with Professor Eduardo Catalano, carried out a feasibility study into the applicability of a systems building approach to planning, design and construction of academic, housing and parking structures for the State University (New York) Construction Fund's extensive physical expansion programs.

JOHN P. EBERHARD, USA

Dean, School of Architecture and Environmental Design, State University of New York at Buffalo.

B.S. Architectural Design, University of Illinois (1952). S.M. Industrial Management, M.I.T. (1959). One of incorporators of Creative Buildings, Inc., from 1952-1958. The firm was initiated to design and build medium-priced homes, but was converted to the design and manufacture of prefabricated buildings, primarily religious structures. In 1959 he joined the Sheraton Corporation of America as their Director of Research where he was concerned with the investigation of data processing techniques and their potential use by Sheraton. Mr Eberhard was the Director of the Institute for Applied Technology at the National Bureau of Standards, U.S. Department of Commerce, an organization which seeks to create opportunities for the introduction of new technology in Government and industry. He came to his present position at SUNY after extensive experience as a consultant to industry, as a practicing architect and as a lecturer in the School of Industrial Mangement at M.I.T.

JACK H. GARNHAM WRIGHT, UK

Partner in Building Design Partnership, London; formerly principal advisor to the Minister responsible (to Parliament) for the national codes of England and Wales.

Diploma Architecture, A.R.I.B.A., partner in BDP with special responsibilities for work outside UK. From 1954 to 1960 he was responsible for building colleges for further education, and for research and construction development work in a large county authority. In 1960 he joined the first Building Research and Development Group to be set up in a UK government department with a direct building programme. In 1967, he took up the post of Principal Architect in the Ministry of Housing and Local Government, to become involved with the national regulations and also with setting legal standards in conjunction with the British Standards Institution following the Ronan Point Disaster. At this time, too, he helped initiate the BRS study of European methods of building control. Throughout this period, his main interests were in the organization of government building to ensure adequate user control; and in the development of technology to obtain the best productivity and value for money in carrying out the national building programmes, mainly for education and housing.

R. HOWARD GOODMAN, UK

Chief Architect, Department of Health and Social Security, London.

Dip. Arch. (hons.) A.R.I.B.A. Has been associated with hospital planning since 1949, both with national authorities and private consultants. He joined the Ministry of Health (now DHSS) in 1960 and has been controlling the Research and Development Group, whose projects include the Greenwich District Hospital and the Bury/Frimley "Best Buy" hospitals, until February 1971 when he was appointed Chief Architect.

EDWARD M. HOSKINS, UK

Director, Applied Research of Cambridge Limited, England.

Qualified as a dentist in 1961 and commenced an architectural course in 1964. He worked at the Centre for Land Use and Built Form Studies, the research group of the School of Architecture, Cambridge University, at the end of his course. Mr. Hoskins was one of the originators of the idea for ARC, and he has worked as the full-time Managing Director since August 1969. ARC is concerned with computer aids in building and planning, and its work to date has mostly been involved with computer applications in relation to systems building.

BURNHAM KELLY, USA

Former Dean, Cornell School of Architecture, Ithaca, New York.

Professor of Planning, College of Architecture, Art and Planning, Cornell University. Currently on sabbatical leave for research project on impact of industrial housing on communities. A.B. Williams College (1933); Harvard Law School J.D. (1936); M.C.P. Massachusetts Institute of Technology (1941). Practiced law, Providence, R.I. (1936-38), admitted to bar 1938. War research-- National Research Council and Office of Scientific Research and Development, scientific intelligence mission ALSOS, G-2, Europe (1945). Teaching-- City & Regional Planning, M.I.T. (1945-60); Dean, Cornell University (1960-71). Retiring as Dean and returning to research and teaching (1971). Mr Kelly has lectured extensively. Among his published works are two books on prefabrication of houses. He was Director of the Housing Association of Metropolitan Boston (1948-60); appointed by President Kennedy to the national Fine Arts Committee (1963-67); appointed by Governor Rockefeller as Vice President of the N.Y. State Council on Architecture; and is a member of the Advisory Committee, American Law Institute, and Model Land Development Code.

GEORGE H. LAWRENCE, UK

Chief Executive, The National Building Agency, Edinburgh.

T.D., F.R.I.B.A., M.R.T.P.I., F.I.O.B. Attended School of Architecture and School of Town and Country Planning, Edinburgh College of Art. 1936, in private architectural practice in Edinburgh followed by town planning experience with London County Council prior to war service. 1946, joined Department of Health for Scotland as Planning Officer and later architect on health centres and educational buildings. Appointed Chief Executive, Scotland, with the National Building Agency, 1964. The N.B.A.'s main functions are to promote the use of improved techniques of design management and site operations in both public and private house building. Responsibility included the appraisal of building systems which at their peak in 1968 accounted for about 40% of the total number of dwellings approved in the public sector in Britain.

FRANK MATZKE, USA

Deputy General Manager, State University Construction Fund, New York.

F.A.I.A. B.A. Rensselaer Polytechnic Institute, Troy, New York (1951). Registered Architect, State of New York. Previous experience includes Senior Architect, Division of Architecture, New York State Department of Public Works, and Architect with W. Parker Dodge Associates, Rensselaer, New York. Mr. Matzke has been Director, New York State Association of Architects, 1966-69, and has held various leadership positions in the American Institute of Architects.

PHILIP J. MEATHE, USA

Executive Vice President, Smith Hinchman & Grylls Associates, Detroit, Michigan.

F.A.I.A. Member of the BRAB Special Advisory Committee on Management of Military Construction for the U.S. Department of Defense and a member of the Board of Directors of Production Systems for Architects and Engineers, Inc. B.Arch., University of Michigan (1948). Associate, Leinweber, Yamasaki & Hellmuth; founder and President of Meathe-Kessler & Associates, Inc. In his 13 years as President, the volume of the firm grew to an annual $40 million, and included a wide variety of building types, including commercial facilities, residences, educational buildings and complexes, and Federal housing projects. In 1968 he joined Smith Hinchman & Grylls Associates, one of the ten largest architectural/engineering/planning firms in the U.S., with present projects in excess of $600 million. Mr. Meathe has been an active member of the A.I.A., holding many offices including president of the Detroit Chapter, and Chairman of the Public Relations Committee.

RICCARDO MEREGAGLIA, ITALY

Chairman & President, Impresa Generale Costruzioni MBM (Balency), Milan.

Graduated in 1941 as a civil engineer at the Politecnico of Turin, Italy. Since 1944 he has been owner of the Impresa di Costruzioni Ing. R. Meregaglia e C. of Milano, which has built many important civil and industrial buildings in Milan and elsewhere. Early in the Sixties the necessity of restructuring the Italian building trades on an industrial basis became evident. Mr. Meregaglia clearly recognized this and while continuing the conventional activity of his organization, he created a second company with the structure of a truly industrial undertaking-- Impresa Generale Costruzioni MBM, using the Balency System of prefabrication, and having a production capacity of four to five apartments per day. The Balency System has not been developed in six nations where they have produced more than 30,000 dwellings. Building Systems International (BSI) was formed in the U.S. to implement the Balency System here, and was selected by HUD for Operation Breakthrough As a joint-venture with Westinghouse, BSI was given the study for Fort Lincoln, a new town to be built near Washington, D.C. for 20,000 people. Mr. Meregaglia is vice-president of AIP (Italian Prefabrication Association) of CRESME (Center for Economic and Sociological Research in the Building Market), president of the Prefabrication Committee of ANCE (the Italian Constructors' Association), and member of various commissions. He has been author of many reports to international building congresses and of numerous articles in international technical magazines.

STANLEY MEYRICK, UK

Chief Architect, University Grants Committee, London.

Studied architecture under Sir Charles Reilly. After war service in the Far East, he worked at the Building Research Station in various branches of architectural physics and in development planning. Since joining the staff of the UGC, he has been closely associated with the programme for developing existing and establishing new universities and colleges in the United Kingdom.

NEAL B. MITCHELL, Jr., USA

Engineer; President, Mitchell Systems, Lexington, Massachusetts.

Mr. Mitchell has taught at a number of universities in the U.S., including Harvard and the BAC, and has lectured extensively in this country and overseas. Professor at Harvard and Director of Architectural Technology Workshop. Engaged in systems building in South America, the Far East, and the U.S.A.

HUGH MORRIS, UK

Architect, Partner in Robert Matthew, Johnson-Marshall & Partners, London.

Trained at the Architectural Association (1945-50). With London County Council Housing Division (1952-60); responsible for work on housing aspects and for editing the Report on "The Planning of a New Town" at Hook, Hampshire (published LCC 1961). Joined Robert Matthew, Johnson-Marshall & Partners in 1960 as group architect for CLASP commissions (primary and secondary schools, old people's homes, library and War Office buildings). Partner in charge of planning and building the University of Bath since 1964-- a continuous involvement in the development of system building. Past President of the Architectural Association.

ERNESTO PAREDES, PERU

Executive Director, Accion Comunitaria del Peru, Lima.

National University of Engineering, Lima; Institute of Urban Studies graduate certificate (1952); Architectural Association School, London; Certificate in housing and planning; Yale University, M.A. City and Regional Planning (1962). Mr. Paredes has been an architect with various firms in Lima and London. He had his own practice in Lima (1956-60), and has been Executive Director of Accion Comunitaria del Peru since . 1968. He was a Professor at the National University of Engineering, Lima (1952, 1956-64). He has served as Director, National Office of Planning and Urbanism, Lima (1960-62), and Secretary General of Public Works (1963-68).

RODERICK G. ROBBIE, CANADA

Principal, Robbie, Vaughan & Williams, Toronto, Ontario.

Member R.I.B.A., R.A.I.C., T.P.I.C. Graduate, Regent Street Polytechnic School of Architecture (G.B.) and later the institution's Town Planning School. Registered Architect, Quebec and Ontario. Member of the Canadian Construction Industry Development Council and Chairman of CSA Advisory Committee on System Building. While partner in the firm of Belcourt and Blair, Mr. Robbie developed and designed what was to become Canada's first fully modular and precast building-- the Canadian Boy Scout National Headquarters, Ottawa. In 1958 he joined Peter Dickinson & Associates, Toronto, where he developed the planning concept and design for the New Town of Frobisher Bay, Baffin Island, North West Territories. In December 1960 he joined as a partner in the formation of the firm of Robbie, Vaughan & Williams where he was responsible for a number of housing and industrial projects and was project director for the Canadian Pavilion at Expo '67 Montreal. From 1966-69 he served as the Technical Director of the Metropolitan Toronto School Board's Study of Educational Facilities (SEF). While with SEF, he initiated with his staff an analysis of user requirements, the SEF Building System and insured its application to a number of schools. He is a founder and director of Environment Systems International Inc., a joint U.S.-Canadian firm concerned with the systems approach to the solution of the problems of the built environment. Since 1970 Mr Robbie has directed RVW's and ESI's involvement in major system based school building projects in Albany, New York, and user requirement studies for the Travel Industry and Office Buildings for the Department of Industry, Trade and Commerce.

ROBERT RUCKTERSTUHL, USA

Director, Design and Construction, State University Construction Fund, New York State.

Prior to coming to the Construction Fund, Mr. Ruckterstuhl was with the New York State Department of Public Works. He is a Registered Architect, and received a B. Arch. from Rensselaer Polytechnical Institute, Troy, New York (1957).

CARLO TESTA, ITALY

Architect, co-author "Systems Building: An International Survey of Methods", Turin.

M.S. Industrial Design, IIT, Chicago (1965). Dip. Arch., HFG. Ulm/Donau, Germany (1963). Worked with Inland Steel Products Co., Milwaukee, Wisconsin in research and development (1964-65). Chief Development Architect of Brockhouse Steel Structures Ltd., West Bromwich, UK working on design of the Israeli version of the CLASP system (1965-68). Visiting Professor, Washington University School of Architecture (Spring 1971). Projects include: management of the project EDOCC-FRANCE (Paris); design of educational buildings (primary, secondary and universities) in several countries; Managing Director of Servicio Tecnico de Construcciones Modulaires (Barcelona); coordinator of the feasibility study for the First European Open Plan School System; redesign of Swiss version of the CLASP system, Zurich; co-author of "Systems Building; an International Survey of Methods". Mr. Testa is a member of Associzaione Italiana Prefabbricare, Italy.

YOSHOSHIKA UTIDA, JAPAN

Professor of Architecture, University of Tokyo School of Architecture.

Trained as an architect, Professor Utida has an extensive record of building bearing his name. He was Chairman of the Selection Committee for the Japan Pilot House Program.

JAN van ETTINGER, Jr., HOLLAND

Head, Foreign Division, Bouwcentrum, Rotterdam, the Netherlands.

M.E. (Mechanical Engineerings). From 1962-present Mr. van Ettinger has been with Bouwcentrum Rotterdam. From 1962-1966, as part of the Organization and Efficiency Department, he engaged in consulting to municipal authorities and contracting firms in rationalization of (house) building in the Netherlands, and in research on the same project. From 1967-present in the Foreign Division, he has engaged in education and consulting activities for developing countries in the field of housing, building and planning and of industrial quality control. Special field: Problems and methods of low-cost housing as a worldwide problem.

PERCY WARD, UK

Director, Harness Program, Department of Health and Social Security, London.

Dip. (Hons.) Arch. A.R.I.B.A. Mr. Ward joined the Department of Health in 1965 after working in several large practices in London. He was the Technical Manager of the Greenwich Hospital project until two years ago when he moved into the team working on the Systems/Standards programme. His work in this field includes managing the Data Bases required to Service the System, developing Building Sub-Systems for Harness and acting as Project Manager for the first Harness Hospital which is to be built at Dudley for the Birmingham Regional Hospital Board.

GORDON BEST, UK

Architect, Llewelyn-Davies, Weeks, Forestier, Walker & Bor, London.

B. Arch., Rhode Island School of Design; M. Sc. University of Manchester (UK). Currently undertaking a doctorate programme at University College London, the subject of which is the relevance of cybernetic concepts to health planning. He taught at the Bartlett School of Architecture, University College, London (1965-1968) specializing in design methodology. He has worked as a consultant to a number of architectural planning firms and has lectured throughout the UK and USA. He has published various articles mainly concerned with methodological aspects of planning and design and is presently coordinating the health planning research group in the British planning firm of Llewelyn-Davies Weeks Forestier Walker & Bor.

LEON CHARKOUDIAN, USA

Commissioner, Massachusetts Department of Community Affairs.

Since January 1969, he has been Deputy Commissioner of the Division of Community Development overseeing the state participation in housing and urban renewal. Prior to his appointment as Deputy Commissioner of the new department, Mr. Charkoudian served on Governor Volpe's staff as Administrative Assistant to the Governor. He began his state service as assistant to the Commissioner of the Department of Commerce and Development. He received his A.B., A.M. and Ph.D. degrees from Harvard University. His Ph.D. thesis was an historical urban study. As Commissioner, he conducted research in ways of achieving housing goals in the face of escalating construction costs and submitted legislation allowing for: (1) aggregation of the housing market (with the Department acting as the awarding authority for several housing authorities in Massachusetts), and (2) utilization of a unique bidding system applicable to a systems building approach to construction.

JOHN deMONCHAUX, USA

Partner, Llewelyn-Davies Associates, New York.

Loeb Fellow in Advanced Environmental Studies, Harvard University. B. Arch (honors) University of Sydney, Australia (1960); M. Arch. (Urban Design) Harvard University School of Design (1963). Worked in the U.S. with city planning consultants, specializing in community renewal studies and urban design before going to England in 1964, where he joined the firm of Llewelyn-Davies Weeks Forestier Walker & Bor. As a member of the firm he participated in the Newbury/Swindon New City Study, the preparation of the Washington New Town Master Plan, and directed the Elmwood (Detroit) planning and housing study. In 1967 he became an associate of the London firm responsible for the management of the firm's regional and urban planning work in the United Kingdom, including the urbanization studies for the Third London Airport Commission. He directed the team preparing the master plan for the new city of Milton Keynes, England's first new city planned for 250,000 people. Especially concerned with the firm's work in the fields of new towns and community relations, Mr. deMonchaux' projects include advisory services to community organizations in Los Angeles, new communities in South Carolina and Illinois, and the development of an evaluation methodology for site planning for HUD.

JAMES FALICK, USA

Senior Vice President, Caudill Rowlett Scott, Health Facilities Division, Houston, Texas.

A.I.A. Honors graduate in architecture; Masters Degree in Health Facility Design, both from Columbia University. Prior to joining CRS, he was responsible for hospital design with a New York City firm specializing in health facilities. As Director of the CRS Health Facilities Division since its inception, he has been involved to some degree in each project undertaken. Other representative experience includes a large number of mental health facilities and special studies.

RICHARD JACQUES, USA

Richard Jacques, Architect, Albany, New York.

B. Arch. Rensselaer Polytechnic Institute, Troy, New York (1959). From June 1963 to September 1969 he was with the State University Construction Fund, holding a number of positions including that of Supervisor of Planning and Design Research, and Director of Research and Development. In 1968 his responsibility was expanded to embrace the development of comprehensive client/user programs as a basis for commissioning private architects for Fund work. In 1969 he entered private practice as principal in the firm of Richard G. Jacques, Architecture/Planning of Albany, New York. He is also a founding partner of Environmental Systems International and Managing Director of ESI/Albany. Mr. Jacques has been associated with a number of institutions of higher learning as a lecturer and critic, and has served as a consultant to a number of firms and institutions. In 1968 he was one of four research architects from the world, selected to participate in the UNESCO sponsored Workshop Conference on Planning Colleges and Universities in Developing Countries.

R. CLAYTON KANTZ, USA

Director, Building Systems Projects, University of California.

B.S. Architectural Engineering, Kansas State University (1940); M.A. in Architecture and Urban Design, Cranbrook Academy, Bloomfield Hills, Michigan (1946) (Study under Eliel Saarinen); Graduate study in Engineering Management, University of Alaska (1962-63). Member A.I.A. Private architectural practice, Redding, California (1949-61); Chief architect, Philleo Engineers and Architects, Fairbanks, Alaska (1961-64); Senior Architect, University of California (1964-66); Director, Building Systems Projects (URBS and ABS), University of California (1966-72).

TODD LEE, USA

Architect, Caudill Rowlett Scott, New York.

Todd Lee's work in industrialized building, as an architect with CRS, has been primarily in the field of educational facilities for public authorities. His study of the process by which New York State Construction Fund designs and builds its projects led to the first Fasttrack report which he co-authored. He has been a designer, campus planner and project manager, and is currently responsible for the systems efforts of CRS' New York office. Currently involved in two projects for the New York City Board of Education, Mr. Lee is implementing the pilot effort for systems design and construction for educational facilities in that city. Mr. Lee graduated from Harvard College, B.A. with honors, in 1961. He received his B. Arch. with honors in 1964 from the University of Pennsylvania, and was the Chandler Traveling Fellow for the following year. Upon returning from Europe, he joined Cambridge Seven Associates, working on a wide range of projects. He is registered in Massachusetts. He taught at the Boston Architectural Center for four years, eventually developing a new first year program of interdisciplinary projects.

JOSEPH C. WHITE, USA

President, SYNCON, Milwaukee, Wisconsin.

B.S. in Mechanical Engineering and MBA from Northwestern University. Employed by the Inland Steel Company for eighteen years, his experience included industrial engineering, manufacturing, process engineering, product development and marketing management. He directed Inland's involvement in the California School Construction System Development project, the nation's most comprehensive attempt at industrialization and systemization in the building industry. In June of 1968 he organized SYNCON, a building systems development firm of which he is currently President and Chief Executive Officer. Mr. White has lectured extensively at organizations and universities throughout the U.S. He is the author of a number of published articles.

PETE WILSON, USA

Mayor of San Diego, California.

At the time of the ISBRT Conference, Assemblyman Wilson was Mayor-elect of San Diego, having just won his election (R-San Diego). He was elected to the California State Legislature in November of 1966, re-elected in 1968 and 1970. He served as Chairman of the Assembly Urban Affairs and Housing Committees on Finance and Insurance; Criminal Procedure; and the Select Committee on Environmental Quality. Other responsibilities include: Vice-Chairman of the Urban Development and Housing Committee, Chairman of the Legislative Task Force of the California Interagency Council on Drug Abuse, and a member of the President's Advisory Committee on Environmental Quality; the Joint Legislative Committee of Seismic Safety, and the Joint Legislative Committee on National Tax Policy. He received his law degree from the University of California School of Law at Boalt Hall, and is a partner in a San Diego law firm, admitted to practice in both California and Florida. He was a member of the Jaycees and was named Outstanding Young Man of San Diego for the year 1968. He has authored major legislation in the areas of property tax relief, drug abuse, coastline protection, housing, workmen's compensation, and traffic safety. He was honored by the housing industry publication "House and Home" as top performer of 1969, a national award given for significant contributions to the nation's housing and urban programs.

RAMON ZAMBRANO, USA

Head, Hugh Stubbins/Rex Allen Partnership, Cambridge, Massachusetts.

As an associate with Hugh Stubbins/Rex Allen Partnership (formed in 1968 as a specialized subsidiary to plan and design health care facilities), he investigated and designed the first hospital in the United States that throughout, utilized a truss between floors for carrying all mechanical and electrical equipment. The modular systems approach has since been expanded and will be utilized for the redevelopment of Boston City Hospital. He prepared a modular prototype for elderly housing for NMAF, Washington. Mr. Zambrano has specialized in establishing overall conceptual frameworks with recommendations of principles to guide growth of high-density areas, rather than the traditional or finite architectural master plan with its stress on location of building volumes. His methods have proven to be both cost and time saving.

DUNCAN WILSON

Project Director, International Systems Building Round Table Conference.

A.B. (Geology) Middlebury College, 1960. M.I.T. Sloan School of Management, 1961-63, 1969-70. S.M. 1970. Thesis entitled "A Conceptual Model for Managing Architectural Programming Process at a University", partially based on two years work at M.I.T.'s Planning Office. Former student at B.A.C. First interest in building systems dates from 1962 when, with John Eberhard as advisor, took Carl Koch's Industrialized House course, as management consultant to architectural students developing low-cost, industrialized housing for export to underdeveloped countries. Later draftsman in custom architectural section of Techbuilt, Inc. 1966-67. More recently, Project Director, Systems Building Round Table Discussions, B.A.C.; Consultant for E.F.L. (New York) to investigate systems building activity for educational facilities in Western and Eastern Europe (February 1971, March-May 1972); national analysis of need for pre-engineered, multi-story office structures (as Associate with Weld Coxe Associates, Philadelphia); Researcher for industrialized building systems research team at Hugh Stubbins & Associates, Cambridge, dealing primarily with university and residential housing; and researcher for systems building feasibility study for State University (New York) Construction Fund with Professor A.G.H. Dietz at M.I.T. Also teacher at the B.A.C.: architectural programming; systems; and design studio emphasizing systems building.

ROGER CASSIN

Stull Associates, Inc., Architects (Boston). Systems background includes user need study and systems approach evaluation for project H.O.P.E. while at Case Western Reserve University. Since his association with Stull Associates, Inc. in 1961, he has been involved in design and execution of wood and concrete systems housing.

CHARLES CHALOFF

Project Architect and Project Manager with C.A. Maguire, Architects and Engineers. Educated and experienced in both architecture and engineerings, Mr. Chaloff's earliest systems experience was in the development of prefabricated building systems in wood, concrete, and steel for government, private industry and general application. He took part in the inception of the Techcrete System with both participating architect and engineer. His present work in systems is in documentation, project organization, cost-control and construction management.

ROBERT CHASE

Health Systems, Inc. (Boston). Involved in developing a multi-disciplinary team approach to health care planning and facility construction. This design-build approach, which includes feasibility studies, financing, programming, development of operational models, as well as design and construction, is currently being tested on several projects.

JOHN CUMMINGS

Associate, Carl Koch & Associates, Inc., Architects (Boston), an office internationally known for its work in industrializing the building process during the past 25 years. The firm has been involved in numerous research and development projects with government and industry. Most notably, prefabricated housing systems, including the Acorn House (1946), Lustron (1949), Techbuilt (1954), and the Airforce Relocatable House and USA Home for the Department of Defense in 1961. Mr. Cummings entered the firm in 1963 and has since been involved in the research and development of the Techcrete System, a prefabricated, pre-stressed system which has been widely used for several thousand housing units in the New England area, with several thousand more units in planning around the U.S.

ROBERT DEVORE

President, Health Systems, Inc. (Boston). Former partner in a large Boston Architectural firm, started new joint-venture firm to develop a multi-disciplinary team approach to health care planning and facility implementations; a design-build approach which includes feasibility studies, financing, programming, development of operational models, as well as design and construction.

JOHN ELLIS

Involved in development and applications of different building systems in England over several years. Also with Campbell, Aldrich & Nulty, Architects (Boston), completed a study with Arthur D. Little on hospital building systems for the U.S. Department of Defense. In housing, did an evaluation of an Operation Breakthrough semi-finalist. In education, was involved in a multi-disciplinary study of feasibility and implications of introducing a building systems (SCSD-type) approach within the Massachusetts School System. Presently with Ezra Ehrenkrantz at Building Systems Development, Inc., New York City.

EASLEY HAMNER

AIA, Associate, Hugh Stubbins & Associates, Architects (Cambridge). Systems involvement through complete student housing projects utilizing prefabricated wood modules and on a joint venture basis with a major New England modular manufacturer. Office investigation into classification and evaluation of sub-systems for prototype buildings--speculative venture with real estate developers.

THOMAS HOLZBOG

Environmental Planners, Inc. Architects (Cambridge). Designed prototype modules for wood-framed housing; included modules for three prototype town-houses as well as modules for an apartment block. Modules were developed with pitched roofs, meeting width and height limitations for highway transportation, resulting in a domestic scale (sympathetic to the environment) with standardized utility cores and stairways, while unit sizes remained flexible and expandable.

MICHAEL JOLLIFFE

Associate, Nichols, Norton & Zaldastani, Consulting Construction Engineers (Boston). Collaborated with architects in the analysis and evaluation of housing systems leading to the development of a 3-D system based on light-weight, non-combustible components. Responsible for systematic, on-going development of a system for parking structures.

RICHARD KRAUSS

Principal, Ashley, Myer, Smith, Inc., Architects (Cambridge), and the Environmental Design Group; a Loeb Fellow at the Harvard Graduate School of Design (Cambridge). Recently Mr. Krauss has been a consultant to the Department of Architecture at M.I.T., doing research on the design process and computer techniques; Consultant to the Ministry of Public Buildings and Works, London, developing a computer system for use by government architects; and a special assistant to the Director, Institute for Applied Technology, U.S. National Bureau of Standards, doing research of performance specifications, user-needs, cost-benefit analyses.

NICHOLAS KUHN

Formerly with the Public Facilities Department of the City of Boston, Director of the BOSTCO Project; Boston Standard Component Systems, a systems building program involving all new school construction in the City of Boston. Currently with Wilson Rains & Associates, Architects and Systems Consultants (Cambridge).

EDWARD T.M. TSOI

Sert, Jackson and Associates, Architects and Planners (Cambridge). Ed Tsoi is presently working on 1000 housing units being designed for the New York State Urban Development Corporation, which is to be located in New York City on Welfare Island. The firm has been exploring numerous European and American building systems for application to Welfare Island as well as to other housing projects presently under design. Mr. Tsoi has also done research for Urban America, Inc. in the development process of low-income housing, and written a paper entitled "Low-Income Housing Primer". He has presented a paper to SBRTD on "Financing of Low-Income Housing: Federal Government's Role in Subsidized Housing Costs for Low-Income Families".

1. Duncan Wilson and Hazel Hyde
2. Sanford R. Greenfield
3. Gerard Blachere
4. Michael Brill
5. Professor Yoshoshika Utida
6. D. Wilson, George Lawrence, Sheila Clibbon
7. Riccardo Meregaglia and Colin Davidson
8. Neal Mitchell

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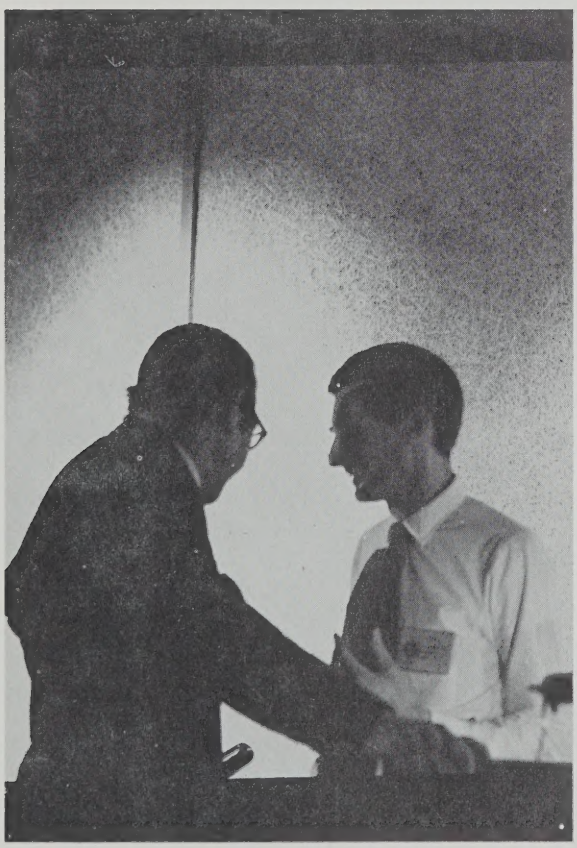

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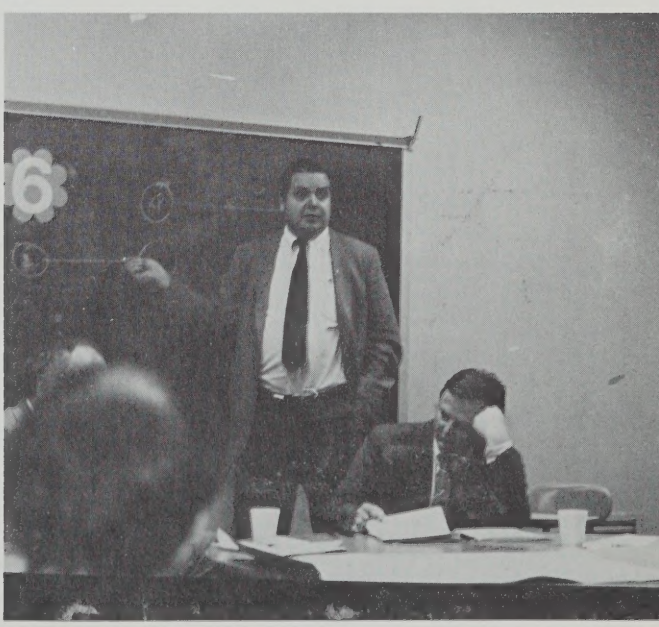

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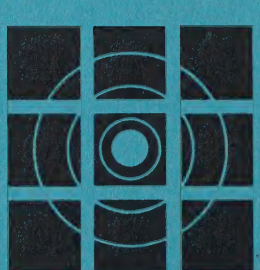

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